DOCUMENT RESUME

ED 252 668 CE 040 430

TITLE Oregon Agriculture IV Curriculum Guide.
INSTITUTION Oregon State Univ., Corvallis. Dept. of Agricultural Education.
SPONS AGENCY Oregon State Dept. of Education, Salem.
PUB DATE 84
NOTE 804p.; For related curriculum guides, see ED 105 726, ED 232 031, and ED 241 712.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF05/PC33 Plus Postage.
DESCRIPTORS *Agricultural Education; *Agricultural Production; *Animal Husbandry; Behavioral Objectives; Check Lists; Classroom Techniques; Computers; Construction (Process); Cooperatives; Course Descriptions; *Farm Management; Guidelines; Job Search Methods; Leadership; Learning Activities; Lesson Plans; Marketing; Pesticides; Recordkeeping; Records (Forms); Small Engine Mechanics; State Curriculum Guides; Student Evaluation; Teaching Methods; *Vocational Education
IDENTIFIERS Irrigation

ABSTRACT

This curriculum package is designed to assist teachers in preparing fourth-year vocational agricultural curricula to meet local community or regional needs. Provided in the introductory section are instructions for using the guide, suggestions for designing curricula that are sex fair and that are suitable for use with disadvantaged and disabled students, a planned course statement, advance planning suggestions, a curriculum validation statement, and a four-year course outline. Forming the bulk of the guide are 12 units dealing with the following instructional topics: securing a job; irrigation and home irrigation; production records; project initiation; agricultural agencies and cooperatives; small gasoline engines; farm business management; marketing; an ideal farm project; completion of an ideal farm project; computers; pesticides; agricultural building construction; leadership; and beef, sheep, and swine production. Each of these units contains some or all of the following: general guidelines to the instructor, objectives, a list of suggested teaching aids, suggested student activities, suggested references, introduction ideas, a unit table of contents, an instructional outline, sample records and forms, assorted checklists, supplementary instructional text, additional exercises and learning activities, and assorted survey and evaluation instruments. (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED252668

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

S J Cole

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

Introduction Preference

Oregon State University's Department of Agriculture Education directed the development of this curriculum package under a grant from the Oregon Department of Education. The opinions expressed herein; however, do not necessarily reflect the position or policy of the Oregon Department of Education, and its endorsement should not be inferred.

Materials used in this curriculum package were adopted from curriculum materials available in other states, developed by vocational agriculture teachers in Oregon and/or by Oregon State University curriculum project staff. We sincerely appreciate and acknowledge the contributions made by the following institutions to the Oregon curriculum guide:

1. Vocational Instructional Services, Texas A & M University.
2. Vocational Agriculture Services, University of Illinois.
3. Vocational Education Productions, California Polytechnic State University.
4. Oklahoma State Department of Vocational and Technical Education, Stillwater, Oklahoma.
5. Oregon State University Extension Materials, Oregon State University.

Gratitude is also expressed here to members of the Curriculum Project Advisory Committee who advised on content and format as well as field testing the draft copy of the curriculum guide. Members were:

1.	Dave Hall	Wallowa High School
2.	Dave Yost	Joseph High School
3.	Jerry Booth	Glencoe High School
4.	Phil Ward	Central High School
5.	Jacque Deeds	Clatsop High School
6.	Preston Winn	Sherman High School
7.	Mike Pratt	Bonanza High School
8.	Herschel Weeks	Cascade High School
9.	Les Geren	Sandy High School
10.	Mike Williams	Gervais High School
11.	Sue Fisher	Silverton High School
12.	Tom Wright	Madras High School
13.	Gary Sundseth	Crook County High School
14.	Charles Ramos	Rogue River High School
15.	Bryan Starr	Sutherlin High School
16.	Loren Bebb	Prairie City High School
17.	Roy Whitman	Amity High School
18.	Rob Horn	Oakland High School
19.	Dona Coon	Jefferson High School
20.	Scott Van Nice	North Powder High School

Selection	Title
A	Introduction A. Table of Contents B. Use of Curriculum Material C. Disadvantaged and Handicapped Student use of this Material D. Sex-Bias Statement E. Planned Course Statement F. Advanced Planning Suggestions G. Curriculum Validation Statement H. Four-Year Unit Outline
B	Orientation
I	Securing a Job
II	Irrigation
IIa	Home Irrigation
III	Production Records A. Beef B. Sheep C. Swine D. Dairy
IV	Project Initiation
V	Agricultural Agencies and Cooperatives
VI	Small Gasoline Engines
VII	Farm Business Management
VIII	Marketing
IX	Ideal Farm Project
X	Project Conclusion
XI	Computers
XII	Pesticides
XIII	Agricultural Building Construction
XIV	Leadership
XV	Beef Production
XVI	Sheep Production
XVII	Swine Production

Use of Curriculum Material

This curriculum package was developed to be used as a guide which vocational agriculture teachers could use in preparing curriculum which would meet local community/regional needs. The Vocational Agriculture Instructor should use a local Vocational Agriculture Advisory Committee to evaluate the appropriateness of this material to a given locale and eliminate that part of the material which was not appropriate while supplementing with material the advisory committee and instructor deemed appropriate to bring the curriculum package to completion for a specific program.

Remember that the goal of vocational agriculture is to place people in the agricultural occupations of their choice. The instructor should help students set realistic occupational goals in agriculture then, through advisory committee input, designs curriculum which would allow students to meet those goals.

Accountability of vocational programs has been and will continue to be measured by placement of students in occupations appropriate to the subject matter taught. An important criteria for success with regard to a placement standard would be student selection. If you need help with identifying appropriate student selection criteria, refer to the "Policies and Procedures Handbook for Oregon Vocational Programs" by John Oades and Jacquelyn Deeds. Pages 4 and 101 could be particularly useful to the establishment of a student selection policy.

Vocational Agriculture and the Special Needs Learner

Every person in our schools, whether educator or student, differs from everyone else and, therefore, has different needs. Taken to an extreme, nearly everyone has special needs, such as, less than 20/20 vision, insufficient upper-body strength, inability to read at a desired level or speed. Most people can overcome or compensate for their special needs. Insufficient visual acuity can often be corrected by eyeglasses, inadequate strength through the use of other parts of the body as well as technology, low reading skills can be improved if desired and opportunities to learn are available. However, not all persons can compensate for their special needs without help. These are the persons this section addresses.

1. Who are special needs learners?

   In the simplest terms, special needs learners are the students who are failing in your vocational program and will continue to do so unless special help is provided. They are also students in your school who have not yet enrolled in your program but who would probably fail if they did without special assistance. Special needs students will fail or continue to fail without special help.*

2. How can you help a special needs learner?

   You can provide a critical facet of a special needs learner's life--EMPLOYABILITY. Employability means independence and therefore dignity for the special needs learner. However, helping a special needs learner to acquire occupational competence will require the best teaching possible. Effective teaching will required:

   - Knowing the special needs student
   - Knowing this curriculum guide thoroughly
   - Knowing which resources are or should be available to you
   - Being a highly creative problem solver
   - Wanting to work with a special needs learner (without this one, all of the above are immaterial)

---

* These students are not succeeding or cannot be expected to succeed due to one of the following reasons:

1. A handicap or disability (the student will have or ought to have an individual education plan or IEP).
2. Academic disadvantage (the student has not adequately learned to read, write, compute or speak but are not disabled or handicapped).
3. Economic disadvantagement (the student has not learned or does not display appropriate work attitudes for employment in agricultural or agribusiness occupation or to succeed in your program).
4. Limited-English proficiency (the student does not speak, understand, or write English well enough for employment in agriculture or agribusiness).

These characteristics are important when designing instructional strategies and for no other reason.

3. Where do you begin?

"PLANNING." You know that good planning is the foundation of effective instruction. This is doubly true for the instruction of special needs learners. Handicapped or disabled learners will, or should, have individual education programs (IEP). If a handicapped learner will be mainstreamed into your program, you must participate in the development of the IEP. You, as the occupational expert, are a critical member on the IEP team.

The IEP team should also develop an individual vocational education program (IVEP) for each handicapped learner. The IVEP should describe in detail: (1) the competencies that the student should learn, (2) where the student will learn each competency (e.g., class, SOEP), (3) criteria for determining success, and (4) the resources, including aides or peer tutors, materials, resource teacher, etc., that will be needed to accomplish each teaching-learning task. Although IEP's are not required for disadvantaged and limited-English proficiency learners, it may be helpful to form IVEP teams with remedial reading teachers, language or bilingual education teachers, counselors or whomever is appropriate.

4. What information is needed?

You can learn about the special needs student in the IEP/IVEP meeting. You need the information to participate productively in discussions and to plan your instruction later. Questions for which you will need answers are:

- What can the student now do?
- What does the student like to do? In particular, what are the person's occupational interests?
- How does the student learn best?
- What are realistic occupational goals for the student at this time? (Occupational goals can be modified upwards at a later time.)

You can help the IED and IVEP team by providing information on:

- Occupations and employment trends in agriculture and agribusiness.
- Competencies, including basic academic skills, necessary to become employable in specific occupations.
- Resources and support services that you would need so that the student can learn specific occupations.
- Potential SOEP or cooperative work experience sites.

5. How do you teach a special needs student?

Based on an IVEP, you should already know:

- The occupation or groups of occupations the student is preparing for.
- The competencies that the student should learn in Ag II.

- The student's abilities, interests and preferred learning modes.

Knowing these things, teaching now becomes a matter of creative problem solving. Described below are a few simple steps to develop instruction and examples that apply to those steps. In the examples, the occupation for which the special needs student is preparing is irrigation maintenance mechanic. The competency which will be used in the examples is: "Repairing Aluminum Pipe" (this competency would have been listed in the student's IVEP).

(1) Identify the learning steps that the student should complete to attain each competency.

For our example special needs student, you feel that four learning steps should be specified: (1) identify the aluminum type, (2) clean the area, (3) select appropriate filler rod and flux, (4) weld aluminum pipe. The specification of these four instructional steps are based on the student's abilities. Each of these learning steps can be broken down further into small steps; the extent to which you need to break down competencies and learning steps depends on the student's abilities. The less able the student, the more you ought to break down competencies into learning steps.

(2) Identify the appropriate unit(s) in this guide for each competency and/or learning step.

The irrigation unit will help, but you must also go back to the Repair Welding Unit in the Oregon Ag III Guide.

(3) Analyze the teaching aides, student activities, instructional materials (including overhead transparency masters), and unit tests suggested in this guide which relate to the competencies and learning steps.

Reading materials in the Irrigation Unit are written at the 10.2 reading level using the FOG method. If scientific and technical words are discounted, the readability index falls to grade 9.2. The resource room person must assist with the instruction of the reading portion of this lesson. Most special needs students do not read at the 10.2 grade level.

(4) Use the suggested activities, materials and tests OR modify them so that they are appropriate for the student OR select other more appropriate methods, materials and testing procedures based on the student's abilities and how s/he learns best.

Suppose our example student is deaf or hearing impaired but is able to read the materials. The suggested activities and materials would be appropriate. During demonstrations,

however, you may need to use an interpreter if appropriat
Regardless, make sure that the student can see you clearly. Also, make sure you are not talking and showing at the same time; the student may not be able to "listen" and watch you and the interpreter at the same time. You may wish to discuss with the student the best ways to communicate when you first meet as well as periodically thereafter.

Now, as another example, the student is mentally retarded with a third-grade reading level. You also know that this student will work under relatively close supervision on the job and can receive oral instructions. The person also has difficulty assimilating concepts and learns best through actual practice with many repetitions of a task. The suggested reading materials may be inappropriate for this student. You may wish to include the student with other students when you demonstrate welding aluminum pipe; however, individualized instruction will more than likely be needed. Instructional aides, peer tutors and "buddies" could be very useful for the individualized instruction.

As a final example, the student is "normal" but has not learned to read adequately. The student can read at approximately the sixth grade level, but the suggested material in this guide is written at the 9.2 grade level. Knowing the student's occupational goals, even if tentati is critical. If the group of occupations for which the student is preparing requires a reading ability of grade six, then alternative means should be provided so that the student can learn the information in the suggested materials without reading them. If, on the other hand, the occupations require grade 9.2 or higher reading ability, then the student should learn to read at that level. The suggested materials in the unit could be used as a medium through which the student can improve reading competence. You can help the student.*

(5) Assure that the student has acquired each competency.

The students in our examples, regardless of handicap or disadvantagement, need to perform every competency specified in the IVEP to the level of quality required by employers. Imcompetence in the student should neither be tolerated by you nor expected by the employer. However, testing should be fair; expect what an employer should expect -- performance under realistic conditions. For our example, close supervision will be provided to the mentally retarded student on the job; realistic supervision should also be provided during the testing. You may also need to retest periodically to assure that the student maintains competencies.

---

*A Methodology for Reading Skill Improvement in Vocational Secondary Programs has many hints on how you can help special needs students to learn to read. Copies of this document is available from your regional vocational education coordinator and the Division of Vocational Education, Oregon Department of Education.

6. How do you use aides, peer tutors, and resource teachers?

It usually requires more personnel time in one form or another for special needs students to acquire necessary competencies than it does for other students. Specifying who can best provide the additional time should have been accomplished during the development of the IEP and/or the IVEP.

Special needs students should work with a resource room or remedial reading teacher or other persons in your school with your close cooperation. Effective interaction with other teachers, counselors and specialists in your school may need to be developed. A sense of mutual trust and respect between you and other persons working with the student, such as the resource room teacher or the remedial reading teacher, is a necessity. You can help them when they work with special needs students on occupational competencies, including the basic academic skills needed to function on the job. They can serve as a wealth of information and ideas to you on appropriate teaching methods and techniques for a special needs learner. Are you willing to take the first step towards developing effective relationships?

Special needs students should work with aides and peer tutors in your classroom on labs under your supervision. Aides and peer tutors should be prepared to work with special needs students. They should be informed of the occupational goal for the student. Then, for each competency, you should inform them of the learning steps and show them how to teach each one. You should periodically check the progress being made and confirm what the aides or tutors are doing. As an alternative, you may wish to work directly with the special needs students when needed. During these periods, it may be appropriate for aides and peer tutors to work with the other students in your class.

7. What if the student attains all of the competencies listed in the IVEP and is capable of learning more?

A meeting of the IEP/IVEP team is imperative. It may be advantageous to increase the number of competencies that the student can learn in Ag IV for the occupation(s) previously identified. It may also be possible to increase the number of occupations for which the student is being prepared.

8. Where can I get advice and assistance on working with special needs learners?

Your first source of assistance and advice should be the district's vocational or special education administrator. The regional vocational education coordinator in your county's ESD is another source of advice and assistance on teaching special needs learners. Your regional coordinator should also be able to help you with developing IVEP and instructional teams within your school. If neither types of persons are available to you, contact the Agricultural Education Program at Oregon State University (Phone:

754-2661) or the Vocational Education Special Needs Project (Phone: 754-2586) for assistance with specific teaching methods and materials and with forming IVEP teams in your school.

Eliminating Sex Bias in Vocational Agriculture Class

Another goal of this curriculum guide was to assure that there was no sex-bias or sex-role-stereotyping in vocational agriculture classes. The following article by Paula Diperna entitled "Up On The Farm" was included so that the Vocational Agriculture teacher may use it to help students understand the problems of sex-bias and sex-role-stereotyping and as a recruiting tool to encourage young women to enter agricultural occupations.

Every effort has been made to remove sex-bias from the curriculum material contained in this package. As the instructor develops material to supplement this curriculum guide to meet local/regional needs they are encouraged to avoid sex-bias/sex-role stereotyping.

Up On The Farm

by Paula Diperna

Most city folk tend to be naive about life down on the farm. They think of cows mooing, pigs oinking and chickens scratching around the barnyard. They also harbor images of farm women with their hair in buns, doing little more than churning butter and organizing quilting bees. However persistent these preconceptions are, reality simply does not bear them out. Agriculture is a complex and demanding science, offering a wide variety of career opportunities, and women are participating at every level in unprecedented numbers. Women now own farms, manage farms, loan money to farmers, promote farm products, write about farms, lobby farm issues, sell farm equipment and supplies, teach farming techniques, run farm machinery, plant, landscape, milk, work livestock and harvest crops. Female attendance at agricultural colleges has jumped radically, with some schools reporting 100 percent increase in just a few years' time. Today, women make up one-third of the undergraduate agricultural enrollment. The word is out--women on the farm are anything but down.

FEMALE FARM LABOR: THE BACKBONE OF AMERICAN AGRICULTURE

Women have been integral to the American agricultural process since the first seeds were sown in the new colonies. Farming then was a family proposition, and the farm woman usually was a wife who ran the household and pitched in with the chores--the stoic, hard-working, invariably dependable backbone of the family--farm unit. In fact, without female agri-labor, the rapid development of American agriculture never could have taken place.

It is interesting that women have always performed a wide variety of farm duties. Sherry Thomas, a former sheep rancher and coauthor of Country Woman: A Handbook for the New Farmer, is currently compiling an oral history by interviewing women who've been involved in agriculture for years. "I'm seeing that what is often regarded today as 'strange' behavior for women--like heavy farm work--has always been acceptable on the farm itself." Indeed, farm magazines in the less-than-liberated early 1900s ran numerous articles with titles such as "Beekeeping for Women"; "Three Women Who Make Mammoth Bronze Turkeys Pay Well"; "The Mistress of Overlook Farm." In 1907, a lengthy article in Farm and Fireside magazine explained: "Of late years, a constantly increasing number of women have graduated into the ranks of independent farmers, owning or leasing farms on their own responsibility and personally superintending every detail, from the purchase of the seeds to the marketing of the produce. The pioneers...are the widows of practical farmers (but they) have been joined in many localities by other women who have migrated from cities and towns...simply because they were convinced that the work would prove more congenial than any of the other occupations open to women."

These words might just as well have been written today about the many women actively involved in farm production, who have to be part scientist, part business whiz, part magician--and plenty on the ball.

TODAY'S WOMEN FARMERS: SHREWD AND PROFESSIONAL, 365 DAYS A YEAR

Kaye Fisher and Margaret (Maggie) Fessard, for example, run a 272-acre dairy farm in upstate New York with 100 head of registered Holstein cattle. The farmhouse is at least a century old, and the farm iteslf originally belonged to Fisher's grandfather. Fisher grew up on it and was right-hand helper until she went off to become a biology teacher. After two years in the classroom, she went back to take over the farm because she "just felt that was where I wanted to be." Fisher was not formally prepared for her new role. "There was a lot of things I'd never bothered to learn, or that my father hadn't bothered to teach me because nobody expected that eventually I'd be running the place." Fessar, also a teacher, and a city woman with absolutely no farming background, came down for a summer to visit and stayed on, learning by trial and error. Her initiation rite was to disc, or break up, a 40 acre pasture--a job considered to be one of a farmer's toughest on a tractor. She did it with no mishap. "I figured if I could do that, I could do anything," said Fessard.

Despite their lack of theoretical background, Fisher and Fessard have enjoyed considerable success. In the four and half years they have run the farm, the milking herd has grown from 16 to 43 head. In addition, they breed cattle, board horses and grow all the feed -- except the protein supplements -- their animals consume. But admirer beware: They work extraordinarily hard.

The day, begun at 5:30 a.m., 365 days a year, and ended at 7 p.m., is taken up with milking, feeding, barnyard and housekeeping, cropping, tending pasture, baling hay, etc., etc., etc. There is only one full-time worker-a male--though there are occasionally part-time workers.

The milking ritual is fascinating to watch. While Fessard cajoles the Holsteins back into the milking area from the outdoor pastures, Fisher settles them into their stalls. She barely can be seen amongst the cows -- their shoulders are about even with her shoulders. Clearly each animal has an individual personality quirk, which is jokingly catered to, and each cow is called by name. In every aspect of their operation, Fisher and Fessard project shrewd professionalism, efficiency and common sense. They have a good time, too, and so do the cows. Music is piped in during milking, and when I asked if it was for the cows' benefit, Fisher replied with a smile, "Well, we all enjoy it."

Fisher shudders at the thought of what the farm would be now if she hadn't taken it over. Not only would it have passed out of the family, also "the land would be lost, to agriculture, chopped into tiny tracts. Someone comes by almost every month to see if I'll sell off a piece." Not likely.

BEAUTIFUL OATS

Melda Snyder, of Flemington, New Jersey, has managed her farm alone for 11 years since her husband died. It's a magnificent 530-acre area, which grows corn, wheat, oats and alfalfa, and supports beef and dairy cattle. With eyes trained from years of experience, Snyder can spot a bad row of corn among fields of good ones. "Now here's a really sad bunch, but aren't those the most beautiful oats you've every seen? I learned how to run things through osmosis, really. Clifford and I always made decisions together, so when the time came, I knew enough about the farm to keep it going."

Today, in addition to managing her farm, Snyder is vice-president of the New Jersey State Board of Agriculture and is a prime mover and shaker for farmers in the area. Though she is mainly concerned with farm management, she is still not above driving the hay wagons, and she radiates a farmer's free spirit and self-sufficiency. "People wonder why we farmers are so independent; well, it's a great relief to know you can grow your own food, if necessary."

Though Synder holds a variety of degrees, has studied architecture and managed school systems, she said of her farm life style. "I simply couldn't live any other way and be happy."

GREENGROCERIES

From North Carolina, Dorothy MaClean Slade drives to New York City every week with her family to sell their produce in the flourishing Greenmarket. She appears to love chatting with the shoppers who crowd the farmers' stalls, thrilled with the opportunity to buy directly from the farm. Her family has owned their farm for 40 years, and though Slade intended to be a nurse, she had to drop out of school for financial reasons and since has made a success of 400 cleared acres of land. "We grow everything you can name and love doing it. If my daughters want to take over the farm, that's great with me."

BIODYNAMIC FARMING

Of all these women, Anne Mendenhall has been actively farming the longest. She owns 280 acres near Aurora, New York and she capsulizes her 20-year career into a few lively sentences: "In 1958, I left my Madison Avenue ad-agency job and came up to Cornell to study farming. I lived on a poultry farm and got a scholarship to put myself through school. One of my professors told me that Iowa was a farmer's promised land, that it had the best of everything. So off I went. When the best of everything eluded me, I came back to the Itahaca area. This place has been owned by a professor; he died, and his wife decided to sell it. I didn't have any money to put up, but she sold it to me on faith; I've been here every since." Today, Mendenhall champions biodynamic farming and brings skeptical neighbors around to see the results she has obtained by using no commercial fertilizers or pesticides whatsoever. When we pulled up alongside her field of soy beans in neat, full, green rows, one male neighbor took a long, thoughtful look and said, with undeniable respect in his voice, "Well, I am impressed with those beans."

THE HIGH COST OF FARMING: HOW WOMEN ARE BEATING IT

Owning and operating a farm these days is far from simple, for men or women. Because land prices are now almost prohibitively high, most women who own their land have either inherited it or "married it." Equipment and supplies can run into thousands of dollars per year. In return for enormous capital and labor investment, the farmer receives a fraction of what the consumer spends on the food. Wheat growers argue, for example, that their grain pays them an amount equal to what it costs just to wrap loaves of bread in paper. Despite the odds, women who really want to farm can do so even without owning one. Some women, such as recently graduated Janet Gorst of upstate New York, job-hunt for farm work the way other women scout positions in business. Said Gorst: "My boss wanted someone who could do the job and was willing to learn new techniques. I tractor seed, do everything that I want to do."

Other women have joined in groups, like those who operate Critter Acres Farm in Penngrove, California. Cheryl Perry, who built up the business, rents land and leases a dairy along with two women friends, one of whom still holds down another job in order to pay farm bills. The farm produces goat milk and, so far, has held its own.

FARM - WOMEN'S LOBBIES: "IT'S ABOUT TIME WE HAVE SOMETHING!"

In addition to farms actually run by women, there is an extraordinary upsurge in activity on the part of farm wives. Nancy Smidle of Kewauneed, Wisconsin, for example, convened American Agri-Women (AAW) for the first time in 1974. "It was about time we women had something, she said. "Most farm women know farm operations as well as 'the men do." AAW, which now has 32 state chapters, 3,000 individual members and a total of 30,000 members--if you can include affiliated women's organizations--serves as a powerful farm lobby. Other women's groups abound, and the newly formed Washington-based Rural American Women (RAW) has a task force at work developing acting resolutions for women's agricultural issues.

Pursuing agricultural careers is not without the obstacles inherent when women chart paths previously assumed to be in the male domain. "You always have to work doubly hard to show you can do it," said one agriculture student. "Sometimes you get the feeling that the men don't really want you touching that valuable equipment," said another. Fisher suspects that her neighbors, who now are very supportive of her, originally believed she'd be out of business within a year. Other farm women complain that male workers have difficulty taking orders from females: "It's that Latin macho-American style," said one.

Women are proving by doing, though some hurdles require more concerted action. One of the primary focuses of women's lobby groups has been to challenge farm estate-tax laws. As written in most states, these laws view farm wives as the heirs of their husbands, not as their legal partners. Often, the death of a husband means a wife is liable for estate taxes, which could mean selling off the farm in order to pay them. Yet, if a wife dies, no estate taxes are owed by the husband.

Legal convolutions vary from state to state and all farm women are advised to check their legal status and to plan estate transitions carefully. Joan Adams of Buffalo, Oklahoma, current president of AAW, said: "Unless a wife keeps a separate bank account and shows in dollars and cents what she has put into the farm, her work contribution means nothing to the IRS."

AGRICULTURE SCHOOLS AND FARMERS' GROUPS: WOMEN ARE GETTING PARITY

Colleges around the country are reevaluating their agriculture programs to provide curriculum equity for women, and Colorado State University held a recent conference expressly for that purpose. Well-established programs are also reflecting the new female ranks. Last summer, the Black Agriculturalists-a student group at Cornells' College of Agriculture and Life Sciences-operated a community garden for the Greater Ithaca Activities Center with an all-female staff-five young women, not all of whom had farm backgrounds. Witness Dinah Torres of Valley Stream, New York, who enrolled at Cornell because "agriculture has always seemed like a good thing to me."

This year, Cornell's entering class was 50 percent female, compared with 25 percent in 1967. Leslie Dines, who did her undergraduate work in environmental science and has general agricultural knowledge, was the college's first female recruiter. Her genuine enthusiasm and considerable energy make you wish you'd thought about an agriculture career yourself. To quote Dines, "If the 'hands-on' production farming seems too strenuous or demanding, there are many other routes to go. We are seeing women entering programs all across the curriculum."

Judy Massapny, director of information for the National Grange, agreed. "I don't know if we can say that more and more women are going into farming for themselves, but we certainly see many more women in the agriculture media, in sales promotion, in the research sciences and in the agri-businesses."

Almost no group attests to the growing role of women in agriculture as clearly as Future Farmers of America (FFA), an organization of high-school students preparing for agricultural careers, which for years actually barred women from entering. (They used to sneak in by registering with first initials only.) In 1969, reacting to the general pressure of the women's movement, the group opened its ranks to women, and today, approximately 15 percent of the 508,000 membership is female. Julie Smiley, who intends to make a career in agricultural journalism, was the first female national office of FFA, followed by Peg Armstrong, a farmer national vice-president. Ten of the organization's 50 state presidents are female.

At a caucus of the young women delegates attending the group's recent conference in Washington, D.C., nothing was as obvious as the diversity of their backgrounds. Some were born to the farm, but many others were city kids transplanted to the country, or ones who had chosen agriculture on their own. Each had an equally confident perspective: "Well, the time has come for women in agriculture, that's all," said one. "We can run things better than men, and they know it," quipped another.

President Carter, who had been an FFA member as a young man in Plains, spent 20 minutes with the entire FFA delegation at a special Rose Garden reception. He talked genuinely of their mutual love of the land, then shook hands and chatted with the delegates. One girl said the President looked slightly suprised to see her but, recovering, talked to her "farmer to farmer."

NEW RESPECT FOR AGRICULTURE: WOMEN ARE MAKING IT HAPPEN

Perhaps the most exciting aspect of the women's movement in agriculture is the potential it has to draw together urban and rural people. As America begins to notice agri-women, it must begin to pay more careful attention to agriculture in general. The recent farmers' strike, consumer resistance to higher food prices and rising concern with food quality and food shortages have focused attention on the agricultural segment of the economy as never before. Jean Tetrault, co-author with Sherry Thomas of Country Woman, predicts all this attention could lead to a "renaissance of the small farm." Perhaps she is overly optimistic, but at least we know that if women have anything to do with it, there will be a new respect for an appreciation of agriculture.

As Jill Beckman of Elgin, Nebraska expressed it, "I'd just like to say that I'm glad you're doing this article, because I grew up being embarrassed to say I lived on a farm." One hopes these insecurities are long in the past of American farm women. After all, if intelligent, dynamic women have chosen agriculture as a viable career alternative, there's assuredly more to it than ee-i-ee-i-o.

CAREERS IN FARMING

AGRICULTURAL PRODUCTION-THE REAL NITTY-GRITTY

Be warned. This aspect of farming is not for everyone. The hours are long, the work arduous and the financial rewards of a small farm are erratic and meager at first. Success is possible, but those who farm do so more for the sheer exhilaration of seeing things grow, for the thrill of being close to the land, than for the money that could be in it.

Credit

Though no real data on the subject exist, access to credit to start a farm should be as available to women as to men. In addition to commercial-bank loans (the American Banking Association reports that there are at least 40 female agricultural loan officers around the country), the federal government provides agricultural credit through the Federal Land Bank System, the Cooperative Farm Credit System and the Production Credit Association. For information write:

The Farm Credit Administration
Washington, DC 20578

Education

Learn about the aspect of farming that most interests you and, as Anne Mendenhall recommends, "Take little steps first." All the land-grant colleges-schools which were set up in the 18th century to disseminate higher education-have schools of agriculture. There is a land-grant college in every state, and each one operated an extension service to provide outreach information from the colleges to interested farms. For information, write the land-grant college in your state.

AGRICULTURE-RELATED CAREERS

Here, the possibilities are numerous, not only for learning new skills, but also for applying old ones. Most of these jobs offer wide administrative, managerial and creative challenges. They include:

Agricultural Engineering - soil science, machinery design, farm waste management.

Agricultural Economics - Farm management, business management, international economy, agri-banking.

Agricultural Science - biology, botany, ecology, genetics, breeding, forestry, animal science, equestrian science.

Environmental Science - landscape architecture, aquatic and atmospheric study, natural-resource management.

Food Science - nutrition, food analysis.

Plant Science - vegetable crops, field crops, horticulture, pomology, ornamental horticulture, floriculture, plant breeding.

Sociology and Behavior, Communications - rural studies, agri-journalism, product marketing, sales promotion, data collection.

Agricultural Education - teaching agricultural subjects.

For more information on careers in agriculture, write the college of your choice or:

National Association of Land-Grant Colleges
One Dupont Circle
Washington, DC 20036

PUBLICATIONS

The Department of Agriculture publishes numerous brochures on every aspect of agriculture, many of which are free. Write:

US Department of Agriculture
Publications Division, GPA
Washington, DC 20250

Also order a copy of the 1978 US Department of Agriculture Yearbook, entitled Marking It on a Few Acres, from:

Superintendent of Documents
Government Printing Office
Washington, DC 20402

Another fine source of practical farming tips is Country Woman, by Sherry Thomas and Jean Tetrault, Anchor Press, 1976, $6.95.

Planned Course Statement

Department: Vocational Agriculture

Course Title: Agriculture IV (______________)
Alternate Title
(for the imaginative)

Course Number: ____________________

Length of Course: 36 weeks No. of Credits: 1 Grade Level: 12

Prerequisite: Ag I, II & III Credit by Exam Available ( ) Yes ( ) No

Check one:
( ) Required
( ) Selective
( ) Elective

Alternate Learning Opportunities (check one or more)
( ) Does Not Apply
( ) Independent Study
( ) Off-Campus Experience
(X) Other (Explain in Course Overview)

Course Overview: The course will provide students who have a career interest in agricultural occupations fundamental concepts and skills necessary to begin specific employment preparation. Classroom instruction will be combined with laboratory activities, leadership activities, specific occupational activities and Future Farmers of America (FFA) activities to enhance learning. Supervised Occupational Experience Programs (SOEP) in the form of on-the-farm projects, cooperative work experience in agriculture, supervised laboratory experience, agricultural services projects, and/or farm and/or homestead improvement projects are required of those students who participate in Agriculture IV for the purpose of developing on-the-job skills and refining career choices.

Program Goal at Agriculture IV Level:

The student will:

1. Understand basic agricultural principles and careers which impact production agriculture and agri-business occupations in the employment region served by the high school.
2. Begin preparation for entry into agricultural occupations in production agriculture and agri-business through the study of specific subject matter contained in the Agriculture IV guide.
3. Make career choices based on their abilities, aptitudes, interests, and values.

Course Objectives:

Upon completion of Agriculture IV, the student will be able to:

1. Complete a job application form.
2. Complete a personal resume.
3. Interview for a job.
4. Maintain farm irrigation systems.
5. Set farm irrigation systems.
6. Design a home irrigation system.
7. Complete basic production records for Beef, Sheep, Swine and Dairy animals.
8. Understand Agricultural Agency functions and how to utilize their assistance.
9. Know how Cooperatives work and why they are valuable to production agriculture.
10. Complete repair on small gasoline engines.
11. Service small gasoline engines.
12. Understand theories of operation for small gasoline engines.
13. Understand major principals of Farm Business Management:
    a. supply and demand
    b. diminishing return
    c. equipment management
    d. depreciation
    e. profit maximization
14. Understand major market outlets for agricultural commodities.
15. Use appropriate markets to maximize profit.
16. Put an ideal farm together. Draw on information from all four years of agricultural classes.
17. Complete agricultural mechanics projects appropriate to individual student SOEP's.
18. Run a microcomputer.
19. Run agricultural programs on a microcomputer.

20. Do records and cost analysis on a microcomputer.
21. Understand safety in application of pesticides.
22. Calibrate a sprayer.
23. Avoid overuse of pesticides.
24. Construct a small agricultural building.
25. Do all calculations necessary for bills of materials and leveling an agricultural building.
26. Participate in appropriate leadership activities.

Learning Activities:

1. Individual and group projects.
2. Group discussion.
3. Teacher and resource person presentations.
4. Student presentations.
5. Problem solving activities.
6. Field trips to local farms, ranches, agri-businesses, and agricultural shows and fairs.
7. Viewing slides, films, and filmstrips.
8. Participation in classroom, district, sectional, state and national contests.
9. Completion of worksheets and study guides.
10. Participation in FFA meetings, activities and contests.
11. Participation in SOEP.
12. Keep accurate records of SOEP.
13. Participate in decision making process as applied to instructional areas and goal setting throughout the course.
14. Setting tentative occupational goals in agriculture and working toward them -- revising the goals as appropriate and changing direction.

Assessment Procedures:

1. Written and oral assignments.
2. Individual and group projects.
3. Written and performance tests.
4. Notebook of instructional material.
5. SOEP evaluation.
6. Observation by teacher.
7. One-to-one conferences between teacher and student.

Advanced Planning for Course

Some instructional materials must be ordered in the summer in order to have them on hand when needed. Below is a list of early planning considerations.

A. Order films in June-July or earlier. Major free loan film companies are:

a. The Farm Film Foundation
1425 H. Street, N.W.
Washington, DC 20005

b. Modern Talking Pictures Service, Inc.
#16 Spear Street
San Francisco, CA 94105

c. Vernard Films Ltd.
Box 1332
Peoria, IL 61601

d. Educational Films
The Farm Credit Banks of Wichita
151 North Main
Wichita, KS 67202

e. Safer Oregon
Worker's Compensation Department
Accident Prevention Division
Labor and Industries Building
Salem, OR 97310

Write and get catalogs from these firms and place orders early. Instructional materials available include charts, pictures, informational data, films, and film strips.

1. Allis-Chalmers
Ideal Pictures Film Library
4431 West North Avenue
Milwaukee, WI 53208

2. Amchem Products, Inc.
Agricultural Division
Advertising Department
Ambler, PA 19002

3. American Cyanamid Co.
David Butterfield
Agricultural Division
PO Box 400
Princeton, NJ 08540

4. American Farm Bureau Federation
Information Division
225 Touhy Avenue
Park Ridge, IL 60068

5. American Quarter Horse Assn.
Film Reservations
2736 West 10th
Armarillo, TX 97168

6. American Sheep Producers Council
200 Clayton
Denver, CO 80206

7. Armco Steel Corporation
Training Division
7000 Roberts Street
Kansas City, MO 64125

8. Audio Visual Productions, Inc.
1233 N. Ashland Avenue
Chicago, IL 60622

9. BASF Wyandotte Corporation
100 Cherry Hill Road
Parsippany, NJ 07054

10. Babson Bros.
Babson Bros. Company
2100 South York Road
Oak Brook, IL 60521

11. Blue Anchor, Inc.
Walter Tindell
PO Box 15498
Sacramento, CA 95813

12. JI Case Co.
Ag. Equip. Division
700 State Street
Racine, WL 53404

13. Caterpillar Tractor Co.
100 NE Adams
Peoria, IL 61629

14. Deutz Corporation
7385 Pounce de Leon Circle
Atlanta, GA 30340

15. Dickey-john Corporation
Films
PO Box 10
Auburn, IL 62615

16. Dow Chemical U.S.A.
Film Library
PO Box 1706
Midland, MI 48640

17. E.I. Du Pont & Co.
Advertising Department
Audio Visual Section
Wilmington, DE 19698

18. Elanco
Annette Proctor, Film Library
Eli Lilly & Co.
Indianapolis, IN 46206

19. Elliott Films
2635 Nicollet Avenue
Minneapolis, MN 55408

20. Energy Film Library
DOE Technical Info Center
102 Labor & Industries Bldg.
Salem, OR 97310

21. The Farm Film Foundation
1425 H Street N.W.
Washington, DC 20005

22. Farmbank Services
Joe Basher
12000 E. 47th Avenue
PO Box 39088
Second Floor
Denver, CO 80239

23. The Fertilizer Institute
1015 18th St. N.W.
Washington, DC 20036

24. Gehl Company
Marketing Services
143 Water Street
West Bend, Wl 53095

25. Golden Harves Seeds, Inc.
Charles R. Finley, Exec. V
513 E. Locust Street
Bloomington, IL 61701

26. Grain Terminal Association
PO Box 43594
167 Sneiling Ave. N.
St. Paul, MN 55164

27. Grinnell Mutual Reinsurance Co.
Public Relations Department
1-80 at Highway 146
Grinnell, IA 50112

28. Gulf Oil Corporation
Public Relations Department
Gulf Building
Pittsburgh, PA 15230

29. Holstein-Friesen Association
Box 808
Brattleboro, VT 05301

30. ICI Americas Inc.
Wilmington, DE 19897

31. International Minerals &
Chem. Corp.
Audio Visual Department
501 E. Lange Street
Mundelein, IL 60060

32. International Harvester
Route 71 & Harvester Road
Sheridan, IL 60551

33. Iowa Farm Bureau Federation
Wendall Jarvis, Creative Vis.
5400 University Avenue
West Des Moines, IA 50265

34. University of Iowa
Media Library
Iowa City, IA 52240

35. Kalo Laboratories, Inc.
9233 Ward Parkway
Kansas City, MO 64114

36. Lindsay Manufacturing Co.
Russ Carlton, Adv & Promotion
Box 156
Lindsay, NE 68644

37. University of Maryland
Audio-Visual Services Dept.
Annapolis Hall
College Park, MD 20742

38. Modern Talking Picture
Service Inc.
Rosanne Pollack
5000 Park St. N.
St. Petersburg, FL 33709

39. Monsanto Ag. Products
Larry Evetts
800 N. Lindbergh Blvd.
St. Louis, MO 63166

40. Nat. Cotton Council of Amer.
PO Box 12285
Memphis, TN 38112

41. Nat. Rural Electric Coop. Assn.
2000 Florida Ave. N.W.
Washington, DC 20009

42. North Dakota St. Film Library
North Dakota State University
Fargo, ND 58102

43. Occidental Chemical Co.
Public Relations Dept.
PO Box 196
Lathrop, CA 95330

44. Owatonna Man. Co., Inc.
Bob Duncan
PO Box 547, Hwy. 45 N.
Owatonna, MN 55060

45. Ralston Purina
Checkerboard Square
St. Louis, MO 63188

46. Roche Chemical Co.
340 Kingsland St.
Nutiey, NJ 07110

47. Rohm and Haas Company
Librarian
Independence Mall West
Philadelphia, PA 19135

48. Shwartz Manufacturing
Division of Chromalloy
129 Pine St. South
Lester Prairie, MN 55354

49. Select Sires Inc.
11740 U.S. 42
Plain City, OH 43064

50. Shell Firm Library
1433 Sadlier Circle W. Dr.
Indianapolis, IN 46239

51. Sioux City Livestock Market
News Foundation
128 Livestock Exchange Bldg.
Sioux City, IA 51107

52. Smith Kline Animal Health
Karol Media
933 Pacific Avenue
Kansas City, MO 66101

53. Bill Snyder Films, Inc.
Box 2784
Stoneville, MS 38776

54. Soil Enterprise Corp.
PO Box 128
Stoneville, MS 38776

55. Sperry New Holland
Public Relations Department
New Holland, PA 17557

56. Steiger Tractor Inc.
Box 6006
3101 1st Avenue North
Fargo, ND 58102

57. Tri-State Breeders Cooperative
Director of Public Relations
Westby, WI 54667

58. The Upjohn Company
Corporate Film Library
7000 Portage Road
Kalamazoo, ML 49001

59. USS Agri-Chemicals
Alan Kendall
PO Box 1685
Atlanta, GA 30301

60. Vermeer Manufacturing Co.
Jaap Kroes
Box 200
Pella, IA 50219

61. Washington State University
Instructional Materials Center
Pullman, WA 99164

62. White Farm Equipment
Merchandising Department
2625 Butterfield Road
Oak Brook, IL 60521

B. Get current commodity data information sheets. Annually updated sheets are available in January from:

Stan Miles
219 Extension Hall
Oregon State University
Corvallis, OR 97331
(Phone 754-4821)

1. Ask for:

"Oregon County and State Agricultural Estimates"

Oregon's Leading Agricultural Commodities, Gross Farm Sales, 1983p

Rank	Commodity	Thousand Dollars 1983p	1982r	1981r
1.	Cattle & Calves	290,678	354,268	320,000
2.	Wheat	225,635	247,830	289,950
3.	Dairy	183,147	178,532	166,840
4.	Potatoes	90,663	72,970	87,131
5.	Nursery Crops	89,005	81,705	91,140
6.	Alfalfa Hay	61,411	53,340	42,900
7.	Farm Forest	50,485	41,795	50,400
8.	Christmas Trees	34,367	29,338	23,904
9.	Barley	34,327	26,217	25,000
10.	Winter Pears	34,112	25,431	26,228
11.	Dry Onions	33,490	18,360	49,742
12.	Chicken Eggs	32,441	28,305	31,507
13.	Strawberries	31,702	25,435	18,126
14.	Peppermint	24,750	16,100	21,736
15.	Broilers	23,415	24,840	29,484
16.	Annual Ryegrass	23,162	29,605	29,440
17.	Sweet Corn, Processed	22,501	28,902	21,681
18.	Snap Beans, Processed	19,887	22,541	23,826
19.	Perennial Ryegrass	19,545	23,270	28,770
20.	Greenhouse Crops	19,530	18,285	17,115
21.	Sheep & Lambs	19,331	16,328	16,500
22.	Hops	19,030	26,038	19,195
23.	Sweet Cherries	18,639	21,536	20,128
24.	Apples	17,085	15,625	17,682
25.	Corn for Grain	14,264	11,212	5,639
26.	Hogs	13,411	19,507	17,155
27.	Sugarbeets for Sugar	11,448	8,846	8,849
28.	Hay (Other than alfalfa)	10,304	9,802	6,885
29.	Horses	9,402	9,222	10,166
30.	Bartlett Pears	8,866	9,628	9,805
31.	Orchardgrass	8,653	7,365	4,680
32.	Oats	7,837	8,600	7,015
33.	Tall Fescue	6,876	4,780	2,657
34.	Turkeys	6,875	9,526	9,583
35.	Red Clover	6,513	6,000	4,520
36.	Green Peas	6,512	7,419	7,921
37.	Tame Blackberries	6,127	4,504	3,150
38.	Vegetable & Flower Seed	5,948	6,057	4,611
39.	All Kentucky Bluegrass	5,557	9,341	11,189
40.	Corn Silage	5,361	4,762	4,154

p - Preliminary   r - Revised

Oregon's Leading Agricultural Commodities, Gross Farm Sales, 1983, continued

Rank	Commodity	Thousand Dollars 1983p	1982r	1981r
41.	Red Raspberries	4,937	9,530	6,144
42.	Radish Seed	4,860	---	---
43.	Mink	4,511	5,794	6,669
44.	Filberts	4,304	12,277	11,319
45.	Sugarbeet for Seed	4,098	7,150	6,031
46.	Cranberries	4,076	2,711	4,003
47.	Bulbs	4,010	4,025	3,425
48.	Peaches	3,992	3,772	3,005
49.	Blueberries	3,827	2,550	2,173
50.	Alfalfa Seed	3,545	2,750	4,145
51.	Bentgrass	3,434	4,178	5,616
52.	Chewing Fescue	3,184	4,202	5,278
53.	Cucumbers, Processed	2,927	3,085	3,385
54.	Garlic	2,891	2,581	1,242
55.	Prunes & Plums	2,800	4,140	5,644
56.	Grapes	2,650	2,871	2,338
57.	Cauliflower, Processed	2,648	5,940	2,730
58.	Broccoli, Processed	2,594	3,392	1,699
59.	Squash & Pumpkins	2,559	3,313	2,584
60.	Crimson Clover	2,430	1,630	2,520
61.	Sweet Corn, Fresh	2,382	2,320	2,127
62.	Carrots, Fresh	2,310	2,415	2,889
63.	Cabbage	2,249	2,181	2,421
64.	Dry Field Peas	2,249	2,776	2,469
65.	Cauliflower, Fresh	1,955	1,818	1,888
66.	Tart Cherries	1,914	809	1,610
67.	Mint for Root Stock	1,748	942	594
68.	Red Fescue	1,705	2,792	3,581
69.	Spearmint for Oil	1,660	1,900	1,725
70.	Black Raspberries	1,590	684	782
71.	Honey & Beeswax	1,584	1,540	1,534
72.	Wool	1,577	1,816	3,406
73.	Dry Field Beans	1,548	1,656	8,561
74.	Lettuce	1,483	1,251	1,958
75.	Beets, Processed	1,462	2,018	2,011
76.	Grass & Grain Straw	1,401	983	692
77.	Boysenberries	1,359	1,376	824
78.	Hairy Vetch	1,353	1,058	1,216
79.	Asparagus	1,292	1,104	1,119
80.	Carrots, Processed	1,108	1,918	1,696
81.	Walnuts	1,099	1,830	1,225
82.	Tomatoes	1,056	1,349	1,235
83.	Rabbits	1,011	1,106	1,027
Other Commodities		51,841	46,738	46,630
Total Gross Farm Sales		$1,711,865	$1,733,488	$1,759,574

p - Preliminary. r - Revised.

1982
OREGON GROSS FARM SALES
REVISED ESTIMATES

District & county	Grains	Hay & silage	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All vegetable crops	Specialty products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock & products	Total gross income
	-------------	thousand dollars	-------------												
The State....	294,162	69,416	101,006	145,452	98,232	47,789	118,195	202,243	1,076,495	354,268	178,532	63,121	61,072	656,993	1,733,488
District 1...	75,067	10,801	88,165	45,787	28,057	42,011	87,863	161,431	539,182	40,086	79,461	56,117	28,831	204,495	743,677
Benton.....	3,629	611	7,380	2,605	683	799	5,192	9,400	30,299	2,270	3,826	208	1,227	7,531	37,830
Clackamas..	7,118	965	2,627	1,090	2,389	7,580	11,247	38,546	71,562	6,248	7,516	16,529	7,360	37,653	109,215
Lane.......	5,271	512	4,982	3,135	2,629	861	7,349	9,675	34,414	6,965	7,433	8,289	1,831	24,518	58,932
Linn.......	9,151	1,390	45,408	3,777	833	2,052	6,323	3,100	72,034	6,146	8,720	3,334	5,890	24,090	96,124
Marion.....	14,638	2,228	12,552	30,067	5,025	13,188	37,679	42,978	158,355	6,658	22,865	11,398	4,573	45,494	203,849
Multnomah..	726	123	105	277	158	4,583	6,498	17,257	29,727	1,024	1,655	11	558	3,248	32,975
Polk.......	10,871	1,021	6,321	3,370	3,757	1,075	2,658	5,815	34,688	2,684	5,047	4,785	1,446	13,962	48,850
Washington.	9,202	2,678	5,278	969	6,239	10,627	4,974	25,320	65,287	3,687	13,100	504	2,258	19,549	84,836
Yamhill....	14,461	1,273	3,512	497	6,344	1,246	5,943	9,340	42,616	4,404	9,299	11,059	3,688	28,450	71,066
District 2..	780	480	51	60	46	4,768	360	15,582	22,127	20,281	58,585	283	5,195	84,344	106,471
Clatsop. ..	---	81	---	---	---	81	5	940	1,107	1,639	2,055	4	1,685	5,383	6,490
Columbia...	780	167	51	42	27	1,866	40	4,278	7,251	3,790	2,975	9	392	7,166	14,417
Coos.	---	93	---	---	14	2,422	235	3,754	6,518	5,634	12,438	259	1,109	19,440	25,958
Curry......	---	21	---	---	5	284	---	3,540	3,850	1,741	915	3	790	3,449	7,299
Lincoln....	---	29	---	---	---	76	50	2,320	2,475	1,229	312	8	261	1,810	4,285
Tillamook..	---	89	---	18	---	39	30	750	926	6,248	39,890	---	958	47,096	48,022
District 3...	2,878	1,707	487	1,515	18,445	497	2,203	14,450	42,182	23,805	14,660	3,622	6,584	48,671	90,853
Douglas....	1,935	502	155	27	2,315	442	1,519	11,310	18,205	12,487	998	703	4,109	18,297	36,502
Jackson....	784	844	332	216	15,727	55	581	1,610	20,149	8,706	5,888	2,870	1,820	19,234	39,433
Josephine..	159	361	---	1,272	403	---	103	1,530	3,828	2,612	7,774	49	655	11,090	14,918
District 4..	157,323	14,582	854	36,856	49,744	494	10,731	4,970	275,554	65,857	1,788	2,188	8,366	78,199	353,753
Gilliam....	16,030	267	165	308	---	---	---	10	16,780	4,917	---	---	171	5,088	21,868
Hood River.	---	149	---	---	31,132	138	104	640	32,163	850	514	485	466	2,315	34,478
Morrow.....	37,715	7,589	38	22,429	87	41	550	1,000	69,449	23,251	475	---	1,325	25,051	94,500
Sherman....	19,367	64	---	160	---	---	---	---	19,591	2,253	---	1,690	116	4,059	23,650
Umatilla...	64,342	5,491	651	13,850	5,969	298	9,917	2,200	102,718	22,500	799	13	4,870	28,182	130,900
Wasco......	19,505	888	---	---	12,556	17	160	1,045	34,171	7,477	---	---	1,107	8,584	42,755
Wheeler....	364	134	---	109	---	---	---	75	682	4,609	---	---	311	4,920	5,602
District 5...	33,601	8,527	6,043	30,174	1,653	19	15,700	3,130	98,847	88,087	16,462	24	4,644	109,217	208,064
Baker......	3,203	1,886	53	216	21	---	---	680	6,059	19,973	2,459	3	797	23,232	29,291
Malheur....	14,602	4,548	2,113	28,640	230	19	15,670	50	65,872	49,165	13,125	10	1,274	63,574	129,446
Union......	10,508	924	3,877	683	1,402	---	---	1,250	18,644	7,170	830	8	1,759	9,767	28,411
Wallowa....	5,288	1,169	---	635	---	---	30	1,150	8,272	11,779	48	3	814	12,644	20,916
District 6...	24,513	33,319	5,406	31,060	287	---	1,338	2,680	98,603	116,152	7,576	887	7,452	132,067	230,670
Crook......	1,003	4,591	174	2,765	---	---	36	260	8,829	14,852	475	16	406	15,749	24,578
Deschutes..	523	2,007	95	1,538	---	---	---	920	5,083	4,302	2,351	16	1,664	8,333	13,416
Grant......	329	1,470	---	289	287	---	---	560	2,935	12,291	---	34	1,816	14,141	17,076
Harney.....	1,117	3,260	76	201	---	---	---	10	4,664	22,534	---	---	545	23,079	27,743
Jefferson..	9,430	1,871	5,020	9,768	---	---	1,302	125	27,516	9,423	159	3	926	10,511	38,027
Klamath....	10,417	11,728	20	16,188	---	---	---	735	39,088	30,728	4,591	818	1,472	37,609	76,697
Lake.......	1,694	8,392	21	311	---	---	---	70	10,488	22,022	---	---	623	22,645	33,133

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

BEST COPY AVAILABLE

1983
OREGON GROSS FARM SALES
PRELIMINARY ESTIMATES

District & County	Grains	Hay & silate	Grass & legume seeds	Field crops	Tree fruits & nuts	Small fruits & berries	All veg. crops	Spec. products	All crops	Cattle & calves	Dairy products	Eggs & poultry	Misc. animals	All livestock	Total Gross income
	----------	----------	----------	----------	----------	----------	----------	thousand dollars	----------	----------	----------	----------	----------	----------	----------
The State....	282,307	78,781	88,942	169,230	95,621	54,362	119,894	229,012	1,118,149	290,678	183,147	63,187	56,704	593,716	1,711,865
District 1...	59,965	12,320	77,811	46,794	18,956	46,811	76,247	179,917	518,821	32,532	80,846	57,172	26,145	196,695	715,516
Benton.....	6,157	498	7,049	3,763	503	950	3,918	11,420	34,258	1,760	3,770	185	1,067	6,782	41,040
Clackamas..	4,081	1,005	2,069	1,442	1,224	7,164	10,634	41,220	68,839	4,749	7,210	17,302	6,373	35,634	104,473
Lane.......	3,915	655	5,658	4,008	1,673	870	5,253	10,150	32,182	5,950	7,800	8,128	1,750	23,628	55,810
Linn.......	6,987	1,086	38,195	8,558	697	1,814	6,154	3,735	67,226	4,968	9,100	3,060	6,630	23,758	90,984
Marion.....	10,291	2,620	9,041	24,553	3,660	15,006	31,633	47,395	144,199	5,790	23,232	14,227	3,730	46,979	191,178
Multnomah..	749	109	98	317	115	3,467	7,130	17,852	29,837	650	1,620	11	537	2,818	32,655
Polk.......	9,075	1,314	5,678	2,582	3,022	1,531	1,637	6,810	31,649	2,420	4,884	3,887	1,285	12,476	44,125
Washington.	6,530	3,460	6,003	1,328	3,713	14,545	5,024	26,150	66,753	2,750	13,330	325	1,787	18,192	84,945
Yamhill....	12,180	1,573	4,020	243	4,349	1,464	4,864	15,185	43,678	3,495	9,900	10,047	2,986	26,428	70,306
District 2...	540	612	71	75	55	6,557	333	16,545	24,788	16,418	61,673	303	5,098	83,492	108,280
Clatsop....	---	90	---	---	---	97	8	1,310	1,505	1,100	2,375	4	1,789	5,268	6,773
Columbia...	540	243	71	54	37	2,255	40	4,460	7,700	3,022	2,984	9	359	6,374	14,074
Coos.......	---	110	---	---	15	3,617	210	3,712	7,664	4,564	12,736	271	1,004	18,575	26,239
Curry.......	---	42	---	---	3	435	---	3,551	4,031	1,410	743	3	823	2,979	7,010
Lincoln.....	---	33	---	---	---	111	45	2,637	2,826	980	380	16	264	1,640	4,466
Tillamook...	---	94	---	21	---	42	30	875	1,062	5,342	42,455	---	859	48,656	49,718
District 3...	2,747	1,609	650	1,380	20,065	442	2,122	18,790	47,805	19,026	14,804	2,464	6,297	42,591	90,396
Douglas....	1,760	434	189	27	1,156	296	1,465	14,216	19,543	9,346	950	523	4,202	15,021	34,564
Jackson....	836	843	461	232	18,504	126	541	2,626	24,169	7,494	5,985	1,578	1,489	16,546	40,715
Josephine..	151	332	---	1,121	405	20	116	1,948	4,093	2,186	7,869	363	606	11,024	15,117
District 4...	162,577	15,539	948	51,914	54,955	532	14,059	5,275	305,799	58,370	1,809	2,198	7,484	69,861	375,660
Gilliam....	19,042	278	150	352	---	---	---	---	19,822	4,056	---	---	162	4,218	24,040
Hood River.	---	171	---	---	36,654	140	93	830	37,888	744	525	513	452	2,234	40,122
Morrow.....	42,232	7,990	8	30,145	108	40	172	1,000	81,695	22,332	523	---	1,131	23,986	105,681
Sherman....	19,329	56	---	---	23	---	---	---	19,408	2,024	---	1,660	76	3,760	23,168
Umatilla...	64,604	6,153	790	21,279	6,873	352	13,678	2,350	116,079	20,778	761	25	4,749	26,313	142,392
Wasco......	17,015	779	---	---	11,297	---	116	1,045	30,252	5,262	---	---	660	5,922	36,174
Wheeler....	355	112	---	138	---	---	---	50	655	3,174	---	---	254	3,428	4,083
District 5...	32,598	9,181	5,561	30,952	1,319	20	25,249	3,880	108,760	65,579	16,321	24	3,866	85,790	194,550
Baker......	2,716	1,791	58	210	20	---	---	1,080	5,875	15,890	2,390	3	741	19,024	24,899
Malheur....	14,973	4,753	2,722	28,775	191	20	25,219	200	76,853	33,945	13,078	10	1,009	48,042	124,895
Union......	9,996	1,348	2,781	787	1,108	---	---	1,350	17,370	5,634	853	8	1,337	7,832	25,202
Wallowa....	4,913	1,289	---	1,180	---	---	30	1,250	8,662	10,110	---	3	779	10,892	19,554
District 6...	23,880	39,520	3,901	38,115	271	---	1,884	4,605	112,176	98,753	7,694	1,026	7,814	115,287	227,463
Crook......	1,441	5,160	123	4,659	---	---	62	290	11,735	15,109	470	---	349	15,928	27,663
Deschutes..	449	3,267	62	1,979	---	---	---	1,350	7,107	4,072	2,290	16	2,669	9,047	16,154
Grant......	293	1,474	---	333	271	---	---	560	2,931	9,446	---	162	1,105	10,713	13,644
Harney.....	914	2,320	125	227	---	---	---	10	3,596	17,602	---	---	518	18,120	21,716
Jefferson..	9,140	3,211	3,563	14,071	---	---	1,822	185	31,992	7,887	118	3	950	8,958	40,950
Klamath....	11,006	12,470	10	16,410	---	---	---	2,140	42,036	27,049	4,816	845	1,718	34,428	76,464
Lake.......	637	11,618	18	436	---	---	---	70	12,779	17,588	---	---	505	18,093	30,872

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

BEST COPY AVAILABLE

December 1983

Harvested Acreage Summary*

Oregon Counties, 1983p

Counties	Grains	Hay & forage	Grass & leg seeds	Field crops	Tree fr & nuts	Sm fru & ber	All veg crops	Other	TOTAL
State total.....	1,441,560	1,134,350	351,400	151,315	78,170	16,818	124,529	3,120	3,301,355
District 1......	274,500	187,100	316,720	37,585	39,835	14,925	78,789	2,500	952,025
Benton........	23,000	12,300	25,660	4,190	595	235	5,344	780	72,105
Clackamas.....	24,100	27,200	10,900	920	4,040	3,055	6,765	630	77,615
Lane..........	18,600	29,100	19,400	5,015	3,925	325	6,265	130	82,775
Linn..........	27,450	28,700	153,850	10,870	910	585	7,145	140	229,655
Marion........	46,050	22,500	41,800	13,515	6,835	4,825	38,155	340	174,035
Multnomah.....	3,400	3,300	400	250	105	1,345	2,835	10	11,655
Polk..........	47,000	15,500	23,380	1,810	5,645	528	2,225	320	96,420
Washington....	29,900	26,100	23,960	750	8,830	3,540	4,215	100	97,400
Yamhill.......	55,000	22,400	17,370	265	8,950	487	5,840	50	110,365
District 2......	3,200	38,400	270	110	38	1,551	20	190	43,780
Clatsop.......	---	4,000	---	---	---	28	---	---	4,030
Columbia......	3,200	9,650	270	90	38	650	20	50	13,970
Coos..........	---	12,450	---	---	---	731	---	10	13,190
Curry.........	---	2,600	---	---	---	90	---	120	2,810
Lincoln.......	---	3,000	---	---	---	36	---	10	3,045
Tillamook.....	---	6,700	---	20	---	16	---	---	6,735
District 3......	14,050	84,050	890	620	12,157	175	1,175	190	113,315
Douglas.......	8,600	47,100	350	25	1,950	130	785	100	59,050
Jackson.......	4,600	27,900	540	95	10,003	40	353	40	43,570
Josephine.....	850	9,050	---	500	204	5	37	50	10,695
District 4......	874,550	120,100	2,570	44,060	25,032	162	32,415	70	1,098,970
Gilliam.......	121,950	7,000	400	1,200	---	---	---	---	130,550
Hood River....	---	2,250	---	---	15,400	42	53	---	17,740
Morrow........	209,950	30,500	60	23,260	170	20	215	60	264,240
Sherman.......	136,800	1,250	---	---	12	---	---	---	138,060
Umatilla......	311,050	55,000	2,110	19,500	3,545	100	32,137	---	423,450
Wasco.........	91,400	11,500	---	---	5,905	---	10	10	108,830
Wheeler.......	3,400	12,600	---	100	---	---	---	---	16,100
District 5......	162,450	243,100	16,000	34,125	985	5	11,130	---	467,805
Baker.........	16,650	78,500	150	600	20	---	---	---	95,920
Malheur.......	60,500	100,600	6,550	28,810	115	5	11,070	---	207,655
Union.........	53,500	34,000	9,300	4,215	850	---	---	---	101,870
Wallowa.......	31,800	30,000	---	500	---	---	60	---	62,360
District 6......	112,810	461,600	14,950	34,815	123	---	1,000	170	625,460
Crook.........	5,000	48,000	280	3,135	---	---	40	---	56,460
Deschutes.....	3,110	20,500	200	1,240	---	---	---	---	25,040
Grant.........	2,050	46,000	---	400	123	---	---	---	48,570
Harney........	12,200	116,900	5,000	---	---	---	---	120	134,220
Jefferson.....	30,600	15,200	9,410	16,580	---	---	960	50	72,800
Klamath.......	50,300	73,000	---	12,600	---	---	---	---	135,900
Lake..........	9,550	142,000	60	860	---	---	---	---	152,470

p - Preliminary. * Some totals may not add due to roundings. Acreage estimates are not included for many specialty crops, pastures and rangeland areas.

SOURCE: Compiled by Extension Economic Information Office, Oregon State University.

December 1983

C. Breed Association Address:

Breed association addresses are printed each year in "Agri-Educator." "Agri-Educator" is published twice yearly and can be obtained from the following address:

Agri-Educator
5520-G Touhy Avenue
Skokie, IL 60076

D. Breed Identification Slides

1. Up-to-date breed identification slides are available from:

   a. Vocational Instructional Services
   F.E. Box 182
   Texas A & M University
   College Station, TX 77842

   b. Vocational Agriculture Service
   343 Mumford Hall
   Urbana, IL 61801

Curriculum Validation Statement

1. A research study of Oregon manpower needs in agriculture was conducted to determine agricultural job titles which have potential for placement of high school graduates in Oregon.

2. McClays study on competencies needed by persons employed within various agricultural occupational titles was used to assess the coverage of the technical agricultural competencies contained in the curriculum guide.

3. All job titles and competencies were covered over the course of the four-year curriculum guide and thus the curriculum package (Ag I, Ag II, Ag III and Ag IV) was considered valid for use in Oregon.

4. A group of 16 Oregon Vocational Agriculture teachers formed the curriculum project advisory committee and provided guidance for scope and sequence of the materials. They also provided input for the format of the curriculum guide.

   It was the feeling of the project staff that the best source of information for curriculum content and format for vocational agriculture teachers in Oregon were the vocational agriculture teachers themselves. The names of the advisory committee members were listed in the Preface of the introduction.

The Four Year Unit Outline:

The four year unit outline which was developed by the curriculum Advisory Committee as a guide for vocational agriculture instruction in Oregon follows. This guide was developed and validated using the manpower data discussed in section F of the Introduction.

Ag IV - A - 37

CURRICULUM
for
Vocational Agriculture

SCHOOL YEAR ______________________ DEPARTMENT ______________________

TEACHER'S NAME Oregon Vo-Ag Curriculum

Week Number	Week Date	Special Events	FIRST YEAR-(1st and 2nd Semesters) Name of Course Ag I	SECOND YEAR-(3rd and 4th Semesters) Name of Course Ag II
1			-Intro. Vo-Ag Prog., SOEP, FFA	-Intro. & Records Update
2			-Tractor Operation & Safety	-Fencing (2 wks.)
3			(4 wks)	-Fencing
4	Fri.	Check Record Books (except Frosh)		-Soils (5 wks.)
5			↓	Morphology, Drainage
6			-FFA: History, Org., Programs	Testing
7			(3 Wks) Creed	Fertilizers
8	Fri.	Check Record Books (except Frosh)		Evaluation (Judging)
9			-Small Engines: Prev. Maint. and Winterization	Animal Nutrition (4 wks)
10			-Intro. to Beef: Breeds, Parts,	" "
11			Term, Selection, Thumb Rules Mgmt	Ration Formulation
12	Fri.	Check Record Books (except Frosh)	-SOEP: Decision Making - Select	" "
13			Project, Begin Record Book	Public Speaking (2 wks)
14			-Parliamentary Procedure	" "
15			(3 Wks)	Record Books (2 wks)
16	Fri.	Check Record Books	↓	" "
17			-Christmas Vacation X X X X X X X	X X X X X X X X X X X X X X X X
18			-Intro. to Sheep: Breeds ID, Parts	-Parliamentary Procedure (2 Wks)
19			Term., Selection, Thumb Rules (1½ wks)	" "
20			-Local Adaption-Animal	-Advanced Ferrous Welding (5 Wks)
21	Fri.	Check Record Books	Science (2½ Wks)	
22			-Intro. to Swine: Breeds, Parts	Arc (vertical & horizontal)
23			Term., Slec., Thumb Rules (1½ Wks)	O-A (braze, weld & cut)
24			-Shop: Safety, Skills Demo., Tool	" "
25	Fri.	Check Record Books	ID, & Basic Plans Reading	Preventive Maintenance (3 wks)
26			Intro to: Arc } 2 wks	
27			O-A	
28			-Spring Vacation X X X X X X X X	X X X X X X X X X X X X X X X X X
29			Wood Project } 2 wks	-Plant Sci: Local Adaptation
30				(4-5 wks) Crops (Forages & Cereal)
31			Tape & Die } 2 wks	or
32			Tool Fitting	Horticulture
33			-Plant Sci: Local adaptation	" "
34	Fri.	Check Record Books	Crops &/or Hort.	Livestock Skills (4-5 wks)
35			(4 Wks)	" "
36			↓	" "
37			-Showing & Fitting: Beef	Appendix - Livestock Selection
38	Fri.	Check Record Books	Sheep, Swine - Close school	Appendix - Horses & Horsemanship

BEST COPY AVAILABLE

BEST COPY AVAILABLE

Ag IV - A - 38

KEY

☐ Animal Science
☐ Soil Science
☐ Plant Science
☐ Agricultural Mechanics
☐ Agriculture Business Management
☐ Leadership and Personal Development

Weeks		THIRD YEAR–(5th and 6th Semesters)	FOURTH YEAR–(7th and 8th Semesters)
Number	Date	Name of Course Ag III	Name of Course Ag IV
1		-Intro. & Records Update	-Intro. & Records Update
2		-Land Measurement & (2 Wks)	-Irrigation Systems (2 Wks)
3		Surveying	" "
4	Fri.	-Animal Production (6 Wks)	-Production Records (2 Wks)
5		Genetics, Breeding Programs,	" "
6		A.I., Record Keeping Systems	-Projects (6 Wks)
7		Health,	"
8	Fri.	Sanitation & Diseases	"
9		(symptoms, prevention, cure)	"
10		-Electric Wiring (2 Wks)	"
11		" "	"
12	Fri.	-Electric Motor Maintenance (2 Wks)	-Farmstead Layout (3 Wks)
13		" " "	Lighting, storage, corral
14		-Plumbing (1 Wk)	systems, & ventilation
15		-Informative Speaking	-Persuasive Speaking
16	Fri.	-Record Books	-Record Books
17		X X X X X X X X X X X X X X X X X	X X X X X X X X X X X X X X X X X X
18		-Applications(St.Farmer, Profic.,	-Farm Taxes (2 Wks)
19		-Non-Ferrous & Repair Welding(4 Wk)	" "
20		Metal Identification	-Ag Financing, Farm Law, (4 Wks)
21	Fri.	Aluminum, Cast Iron,	Ag Agencies and
22		Hardsurfacing, High Carbon Steel	Machinery Management
23		-Preventive Maintenance (3 Wks)	" "
24		Tractors & Machinery	-Agricultural Cooperatives, (4 Wks)
25	Fri.	Hydraulic Systems	Agricultural Marketing
26		-Meats (2 Wks)	(Futures, Contracts,
27		"	Open market, etc.)
28		X X X X X X X X X X X X X X X X X	X X X X X X X X X X X X X X X X X X
29		-Plant Science: Local adaptation	-Pesticides (3 Wks)
30		(5 Wks) Specialty crops or	safety, applicator license,
31		Farm Forestry or,	equipment calibration
32		Horticulture or,	-Building Construction (7 Wks)
33		Christmas Tree Production	concrete
34	Fri.	-Harvesting Equipment (5 Wks)	building materials
35		Combines,	building nomenclature
36		Balers-Swathers,	build a small structure
37		Forage Harvestors,	" " "
38	Fri.	Specialty Equipment	" " "
		Appendix - Bees	

*Note: Career information is to be inserted in each unit as it is covered - there is no separate career unit.

Orientation

Teachers Use Guide:

1. This unit was designed to help you orient students to your vocational agriculture program during the first week of class.

2. Included is a:

   a. unit calendar for the Ag IV year.
   b. objectives for the orientation lesson.
   c. outline for the orientation lesson.
   d. Vocational Agriculture department policies.
   e. notebook requirements.
   f. SOEP question and answer sheets.
   g. SOEP policy sheet.
   h. FFA information sheet.
   i. classroom management suggestions.
   j. example: calendar of activities.

3. You should, in the process of teaching this unit, hand out a, d, e, f, g, h, and j from the above list.

4. From number 2 above, items f, g, and h can be used during your summer recruitment effort and also may be given or mailed to parents to help explain the vocational agriculture program and its requirements.

5. The calendar of activities should be completed prior to the opening of school. The FFA executive committee normally has the responsibility of finalizing the program of activities. A good way to complete the program of activities with maximum student input is to have a chapter leadership camp sometime during the summer months.

Ag II - Unit Calendar

Unit Topic	Days	Unit Section
Orientation Records Update	5 days	B
Securing a Job	5 days	I
Irrigation	10 days	II
Home Irrigation	Alternate to Unit II	IIa
Production Records	5 days	III
Project Initiation	20 days	IV
Agricultural Agencies and Cooperatives	10-15 days	V
Small Gasoline Engines	15-30 days	VI
Farm Business Management	10-15 days	VII
Marketing	5-10 days	VIII
Ideal Farm Project	5-10 days	IX
Project Conclusion	20 days	X
Computers	5-10 days	XI
Pesticides	10-15 days	XII
Agricultural Building Construction	30-40 days	XIII
Leadership	Appendix	XIV (Optional Unit)
Beef Production	Appendix	XV
Sheep Production	Appendix	XVI
Swine Production	Appendix	XVII

Introduction to Vocational Agriculture

Objectives:

Upon completion of this unit the student will:

1. Know what they will learn if they stay in Vocational Agriculture for four years.
2. Understand that SOEP is a requirement and a major part of the program.
3. Take information home pertinent to the Vocational Agriculture program.
4. Purchase a notebook and keep all information from Vocational Agriculture class in it.
5. Know and understand the classroom rules and school policies.
6. Understand the grading system used in Vocational Agriculture.
7. Appreciate the value of FFA participation as a major part of the total Vocational Agriculture program.
8. Understand the total program concept of SOEP-Classroom Instruction-FFA.

Outline of Unit

I. School Policies

   A. Student handbook

II. Introduction to Vo-Ag (outline on board or prepare handout form Section I-G)

   A. Four year curriculum and unit calendar (emphasis on first year of program)
   B. What to expect

III. SOEP Requirement

   A. Discuss handout
   B. Take handout home to parents

IV. FFA

   A. Discuss handout
   B. Discuss calendar of activities

V. Notebook Requirements

   A. Distribute handout
   B. Discussion

VI. Grading

   A. Classwork grade
   B. SOEP grade

VII. Student Control Plan

   A. Handout
   B. State a few of your own rules and expectations
   C. Allow students to help you set rules and goals for the learning environment

VIII. Total Program Concept-Summary

   A. FFA-SOEP-CLASSROOM
   B. Explain how each fits into the program

Subject Matter Outline

I. School Policies.

A. Student Handbook.

1. Most administrations want teachers to go over the student handbook with students the first period of the first day of a new school year. If this is the case, comply.

II. Introduction to Vocational Agriculture. (Put four-year unit calendar on the chalk board or prepare a handout to distribute to the students -- i.e., Section I-G of this curriculum guide.)

NOTE: It should be noted that the Oregon curriculum guide is intended to be a guide only. Teachers should adjust the curriculum outline provided to assure coverage of technical agriculture skills and knowledge that is pertinent to the local area.

VOCATIONAL AGRICULTURE TEACHERS - PLEASE ADJUST THIS CURRICULUM TO FIT YOUR LOCAL COMMUNITY NEEDS!!!!!

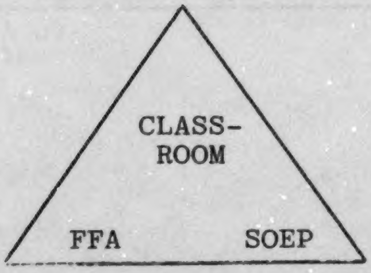
A. What is Agriculture?

To many people, agriculture is thought to be the production of plants and animals to provide the food and fiber for the people of the world. However, agriculture is more than that. Agriculture includes all occupations where knowledge, skills, and abilities are necessary for a person to enter into an agricultural occupation. Agriculture includes farmers, ranchers, buyers and sellers of agricultural products, agricultural mechanics, cowboys, inspectors, salesmen, chemists, teachers. scientists, economists and many other occupations. The total picture of agriculture includes the pure and applied science necessary to get the raw materials onto the supper table.

B. What is Vocational Agriculture?

Vocational Agriculture is an elective subject, offered students who want to work in some phase of agriculture. Vocational agriculture is designed to help prepare students to enter into an agricultural occupation and/or go on to further their education at a community college or at an agricultural college.

Vocational Agriculture has three main components to the program. Vocational agriculture can be pictured as is shown on the next page.



In order for our vocational agriculture classes to truly be successful, we must have all three of the above stated components. Classroom instruction gives the students the knowledge and background information needed to begin working. SOEP gives the students the "hands-on" experience of actually applying the information presented in the classroom. This "hands-on" experience builds the skills necessary to gain employment. FFA allows opportunity to apply skills in a fun way. It also allows opportunity to gain recognition and develop leadership skills. FFA-SOEP-Classroom Instruction= Total Vocational Agriculture Program. These three parts form a triangle. With one part missing, the triangle falls apart. All students must be involved in the three parts for the program to be a success.

The first two years will be mainly exploratory in nature.

The last two years of vocational agriculture will be directed toward preparation for employment or entrepreneurship (owner-operator) in production agriculture or agribusiness.

C. Explain the scope and sequence of the four year unit outline with emphasis on what students will learn and be able to do.

D. Concentrate attention on the first year of the program but describe how the total program fits together.

E. This is a motivational, student recruitment, and student selection effort. Treat it appropriately.

F. How can a student get enrolled in Vocational Agriculture?

1. Students should have an interest or a career goal in some phase of agriculture.

2. All students taking Vocational Agriculture will be required to have an occupational experience program in agriculture to make practical application of the class instruction. Supervised occupational experience programs can provide additional opportunity to develop responsibility, help establish goals, and set values and ideas for young people. The program will be periodically supervised by the Vocational Agriculture

teacher. Examples of good SOEP's are work experience in agriculture, livestock projects, crops projects and home improvement projects.

3. Each student will keep and maintain accurate records on their own supervised occupational experience program or project. This will teach good money management and decision making skills.

4. Each student will obtain a social security card.

5. All students are strongly urged to join and become a part of the FFA. The FFA will be used in the classroom to interest and involve students.

III. Supervised Occupational Experience Program Policy - Vocational Agriculture Department.

A. Introduction.

Due to the many first-hand learning experiences each participant receives in planning, budgeting, feeding, managing, raising crops, construction, exhibiting, record keeping, etc., the supervised occupational experiences program (SOEP) is an essential part of the Vocational Agriculture Program.

B. Policy Statement.

1. Each student enrolled in Vocational Agriculture will have an SOEP (Project).

2. The project should be tailored to fit each student's particular home situation, desires and occupational goals.

3. The student's project is used as a basis for many FFA awards.

   Through the FFA, she/he can receive recognition by exhibiting livestock and crops at various shows, and also receive awards.

4. All students should have some home improvement project.

5. Production projects, cooperative work experience and supervised laboratory projects are also encouraged.

6. Periodically during the school year the instructor will check each student's project record book to evaluate his/her record keeping skills.

7. Evaluation will be on the following basis:

   a. individual performance (progress)
   b. record keeping skills
   c. attitude towards the project
   d. applicability to students agricultural occupational goals

8. A long range plan will be completed by the student with the help of the vocational agriculture instructor and their parents. This plan will project a tentative plan of what the student will do to expand and refine the SOEP over the four years of enrollment in vocational agriculture.

9. Periodically during the school year and summer, the instructor will make project visits to the student's home or place of employment to become familiar with each project, progress, planning and to provide assistance.

10. Satisfactorily meeting the above standards for supervised projects places a big responsibility upon each student in vocational agriculture. However, with a positive attitude, parental support, teacher and older student assistance, we seek each student's full cooperation in this important aspect of their vocational agriculture training.

11. The following pages contain a handout (SOEP Question & Answer Sheet) which students could have to take home to help explain SOEP to their parents.

Supervised Occupational Experience Program (SOEP)
Question and Answer Sheet

A. What is the Supervised Occupational Experience Program?

The SOEP is an out of class project dealing with agriculture. It is a part of Vocational Agriculture curriculum across the United States.

B. What is the purpose of the SOEP?

The purpose of the SOEP is to provide actual training and career experiences in agriculture, for students.

C. Who needs to have an SOEP?

Every Vocational Agriculture student must have a SOEP. It is a part of the agriculture class.

D. What types of SOEP are there?

There are five types of SOEP available:

1. Agricultural Production projects (i.e., crops and livestock projects).
2. Cooperative Work Experience (a job in production agriculture or agribusiness).
3. Home Improvement (i.e., fence repair, landscape improvement).
4. Supervised Laboratory Experience (i.e., manager of school greenhouse or land lab).
5. Agricultural Services (i.e., custom haying or combining).

E. What are some specific SOEP possibilities?

There are many SOEP possibilities. Listed below are a few:

1. Raising a market animal - beef, sheep, swine, etc.
2. Raising a breeding animal.
3. Planting a vegetable garden and selling the produce.
4. Growing a grain crop.
5. Working for a local farmer, nursery owner, etc.

F. By what date must the SOEP be started?

All agriculture students must have a workable SOEP plan by January 10. Student will work on SOEP plans in class early in the school year. Normally the student will have actually started the SOEP by this date; however, some crops, etc., project may not actually get underway until spring.

G. How will the vocational agriculture teacher supervise the SOEPs?

The vocational agriculture teacher will visit each student's SOEP during the school year for the purpose of supervision, assistance, and grading.

H. How will the SOEP affect vocational agriculture class grading?

The SOEP and related record book is worth approximately 10 percent of the total points possible. Any student without an SOEP (or acceptable plan) by January 10 cannot receive better than a "C" grade for the last two grading periods.

I. What makes up the SOEP grade?

SOEP grading is based on two things:

1. The student's SOEP record book.
2. The instructor's visits.

Each student will be given a book in which to keep records on his/her project. A complete and neatly kept record book will receive maximum points.

On the SOEP visit, the instructor will look for project management, whether the student is the primary person responsible for the SOEP, how well it is cared for, etc.

**NOTE: Projects should be of a type that relate to an agricultural occupational objective for the student. Students at the freshman and sophomore level may be refining agriculture course objectives and thus will be permitted some latitude in selecting their agricultural SOEP. With the instructor's assistance, the students will each determine at least tentative agricultural occupational objectives by the beginning of the junior year. At a minimum, the student will indicate "production agriculture" or "agriculturally related business" at the beginning of junior year. The SOEP will focus on gaining experience along the lines of this occupational objective.

IV. FFA.

A. What about the FFA?

The Future Farmers of America, or FFA as it is commonly called, is an integral part of vocational agriculture. Through the activities of the FFA, the in-class instruction can become more meaningful and useful to the students. Therefore, it is strongly urged that all students taking Vocational Agriculture join and participate in the various activities of the FFA.

The largest national student organization in America, made of, by, and for students in vocational agriculture...A chance for you to belong to a group of people who share and actively pursue their interests in the world of agriculture...An opportunity to increase the value of your vocational agriculture program at school by getting involved in agriculture outside of classroom...

That's FFA
THE FUTURE FARMERS OF AMERICA!!!!

*Activities in your FFA

--Field Trips to agricultural areas of interest.

Greenhouses, feed lots, machinery dealerships, animal hospitals. Where would you like to go?

--Contests that give you the chance to learn the best methods of feeding and caring for show animals or for raising crops to show at county fairs, state and even national championships. Compete with other FFA chapters and states in public speaking, crop and livestock evaluation and mechanics.

--Leadership and self-confidence are natural outgrowths of participation in FFA. Members learn to express themselves and organize their group using the same parliamentary procedure that our Congress uses. If leading your group sounds exciting there are lots of opportunities to polish your skills and even contests to compete in to show them off.

--Earn Money and Awards with your chapter or on your own. That SOEP steer you raise may earn FFA awards as well as money. There are awards for team projects or for individual ones. Ribbons, pins, plaques, trophies, and purses are presented by the FFA to winning projects and to successful individuals.

--Travel with team members to districts, regional, state, and national contests and conventions. These are exciting opportunities to see new places and meet people. You can really go places in FFA.

--Community Service is a rewarding part of FFA. Find out how much you have to offer.

--Recreation is a big part of FFA. Picnics, games, hay rides, dances. It's up to you what you decide to do. The list of recreations is only limited by your imagination.

What would you like to do?

It's to your advantage to be a part of today's FFA--

As a student, your future in agriculture depends on your experiences today. In the FFA you will be among people who have related goals and educational interests. The more exposure you have to agriculture today, the better you will be able to find a satisfying place in the field of agriculture tomorrow. It's always more fun to become involved in your field in the company of others who share your interests. Get involved now. You'll always be glad you did!!

B. Example FFA Chapter's Calendar of Activities.

September

- Concession Stand
- FFA Meeting
- District Advisors Meeting
- County Fair
- Freshman Meeting
- FFA Creed Speaking Contest
- District Meeting
- State Officers Leadership Tour

October

- Due Deadline
- FFA Parent Potluck
- Concession Stand
- FFA Meeting
- P.I.L.E. - Portland
- District Soils Judging Contest

November

- National FFA Convention, Kansas City, Missouri
- FFA Meeting
- Hay Ride
- District Advisors Meeting

December

- FFA Meeting
- District Advisors Meeting
- Snow Party

January

- State Farmer Applications Deadline
- State Farmer Formal Interviews
- FFA Meeting
- District Advisors Meeting
- Chapter Public Speaking Contest

February

- Chapter Proficiency Award Contest
- FFA Meeting
- National Chapter Applications Deadline
- District Leadership Skills Contests
- National FFA Week
- District Proficiency Awards Contest
- Sectional Leadership Skills Contest

March

- Chapter Officer Interviews
- District FFA Meeting
- District Officer Elections
- Chapter Book and Record Book Contest
- Coop Quiz Contest
- FFA Meeting
- State FFA Convention
- Slave Sale

April

- FFA Meeting
- FFA Parent/Member Banquet
- Officer Installation
- Tractor Driving Test
- Shop Skills Contest

May

- FFA Meeting
- District FFA Meeting
- Livestock Judging
- Swimming Party
- Graduation

June

- Livestock Shows
- FFA Meeting
- School's Out

July

- FFA Meeting

August

- County Fairs
- Livestock Judging Contests
- State Fair
- Leadership Camp
- State Tractor Driving Contest
- Ag Teachers Picnic

V. Requirements for Agriculture Class Notebooks.

A. Each student will keep a class notebook which is comprehensive, current, and organized in the manner to be described below.

1. A good notebook serves several purposes:

a. record of student's performance in class
b. reference source at some later date
c. study materials for class tests

B. Organization.

1. Each student will have their agriculture notebook (loose-leaf, 3-ring binder type) divided into four sections with each section divider marked in an easily noticeable fashion.

a. each notebook shall have the following four sections in this order:

1. Classroom Notes (in chronological order)
2. Tests (with wrong answers corrected)
3. Home Work and Other Assignments
4. SOEP Record Book

2. Each divider will be properly indexed and all materials will be kept in chronological order. Pages will be numbered and units will be listed on a table of contents immediately following each divider.

C. Evaluation of Notebooks.

1. Notebooks will be evaluated once each quarter. The evaluation will be worth 100 points and will be based on completeness, organization, content and neatness.

2. A grade sheet will be placed in front of your notebook. This sheet will be used by the instructor for recording your notebook grade and comments on the notebook.

3. Deficiencies noted by the instructor should be corrected as quickly as possible. These items will be checked again the next grading period.

4. You are held responsible for the class notes on the days you are absent regardless of the excuse. It is your personal responsibility to see that any deficiencies caused by absences are made up.

5. You will need to bring a pen or pencil with you every day to class. Special note paper may be made available to you for class work.

VI. Grading.

A. The grading system used in vocational agriculture will be a points system.

B. Each assignment will be given a specific number of points (i.e., tests, homework, study guides, charts, SOEP records, lab activities and/or projects, notebooks, etc.).

C. At each nine-week grading period, the total number of points possible will be added. Grades will be determined on the basis of a percentage of the total possible.

90%+ = A
80-89% = B
70-79% = C
60-69% = D
0-59% = F

VII. Discipline and Management Suggestions.

A. Classroom control is a prerequisite to classroom learning and many times the key to control and discipline is good classroom organization and management. Achievement is greatly increased for students who are provided with learning experiences in a well disciplined and well organized atmosphere. Those who are not disciplined waste their own individual opportunities and make learning difficult for others. Positive discipline and classroom control and management can only result through joint effort upon the part of the teacher and student.

Organization

- Set classroom climate by how students enter and leave the classroom.
- Begin class promptly and with real enthusiasm. Use an attention getter or interest approach to motivate them.
- Have a routine in all classroom procedures to give security and establish precedents and policies.

Policies and Standards

- Let student help set policies.
- Keep rules short and simple and adhere to them.
- Develop room standards of behavior.

- Carefully observe all rules expected of the class.
- Use lesson plans that will not be upset by restlessness at such times as before vacation.
- Make assignments clear.
- Be sure class members understand what they are to do. Check to see that directions are really clear.
- Hold every member of the class responsible for knowledge of each concept.
- Grade in terms of achievement of specified lesson/unit objectives.

Personal Qualities

- Learn student's names quickly.
- Be friendly, smile and greet students by name.
- Develop a sense of humor which is the ability to have real fun and to laugh at anything truly humorous.
- Let students know you are capable of laughing with them and at yourself.
- Use your voice to advantage by keeping it rich and calm and never speak over a noisy situation.
- Keep your voice audible but quiet, firm and low-pitched.
- Be impartial and fair. Do not play favorites or hold grudges.

Physical Atmosphere

- See to it that ventilation and air circulation and lighting are good.
- Strive to keep the room pleasant and attractive.
- Use student activity, discussion and exhibits to create interest.
- Keep classroom orderly by sharing house-keeping responsibilities with students.
- Have supplies and equipment conveniently located.
- Have a place for everything and insist that items be kept in the proper place.

Classroom Management

- Keep students busy by providing a full period of work.
- Be prepared; have alternative plans. Plan so students will have enough work all period, yet not frustrated by undue pressure.
- See that the class is busy before meeting the needs of the few.
- Know what each student is doing at all times.
- Divide large classes into smaller work and study groups.
- Avoid interruptions when students are working on a project.

Know Your Students

- Discover student interests and special activities.
- Spread responsibility and give each a chance to gain recognition in a positive way.

- Try to find the strong points of the behavior problem child. Help him/her to achieve.
- Gear teaching experiences to the interests and abilities of the students in class.
- Accept behavior for what it is and what it is trying to achieve. Try to fill the student's need another way so that a child will not have to use unacceptable behavior to gain his/her ends.
- Know your parents and the community.
- Study the seating of students carefully with an eye to possible necessary changes.
- Note acceptance of individuals by classmates.

Discipline Ideas

- Be confident. Do not ignore small things. Be aware of them, and, if possible, correct offenders with quite signals.
- Reprimand in private and not in front of the class.
- Try to handle your own classroom discipline before asking administrative assistance.
- Be consistent!
- Do not let discipline problems drag out. See what needs to be done and take the necessary action.
- Act after thinking through the consequences rather than threaten things that cannot be carried out.
- Be self-controlled.
- Do not argue! Discuss, but do not over-discuss.
- Do not create situations which encourage students to challenge your authority.
- Do not threaten and make "deals" to gain control.
- Listen to the student's side of any trouble-some situation.
- Do not be afraid to stand your ground if behavior is not acceptable.
- Use common sense, have confidence in yourself and trust your judgement.

In Summary

Look at your own self in regard to:

- Self-confidence
- Voice
- Enthusiasm
- Sense of humor
- Personal appearance
- Fairness
- Optimism
- Promptness
- Manners
- Attitude
- Understanding
- Values

- Remember that behavior is caused, so work on the causes as well as the behavior.
- Work with parents and community and not by yourself.
- Do not expect change all at once as change takes time.
- Constantly re-evaluate your classroom techniques and look for any new methods.
- Do your best! No one asks more!

Suggested example of a classroom control plan which could be a handout for students follows (on the next page).

Caution: If you don't intend to comply completely and consistently with the suggestions on the handout - make up a handout of your own which you can enforce consistently. Share and agree on this plan with your administrator and with the students in your class.

The Classroom Plan

General Considerations:

The most important mission of a teacher is to teach. Therefore, no student will be allowed to engage in activities during class that limit the educational process in any way.

To facilitate an optimum atmosphere for learning, the following classroom rules will be in effect:

1. Follow directions the first time.
2. No more than one speaker in the room at a time.
3. Be in your seat when the bell rings.
4. Ask permission to leave your seat.

Should these rules be broken at any time, the following steps will be implemented:

1. The offending student's name will be written on the chalkboard as a warning. It will remain there the rest of the period.
2. Should the student continue to break classroom rules, consecutive checkmarks will be placed behind the name.
    a. One check gives the student the choice of these three options:
        1. twenty pushups, done at the end of the class period
        2. a one-page report on an agricultural subject, due the next day
        3. ten minutes sitting quietly at a desk after school
    b. Two checks mean:
        1. forty pushups, or
        2. a two-page report, or
        3. twenty minutes after school
    c. Three checks mean:
        1. sixty pushups, or
        2. a three-page report, or
        3. thirty minutes after school
        4. an automatic phone call by the instructor to the student's parents

a. Four checks earn an immediate trip to the Vice Principal, as well as one of the choices listed in step c.

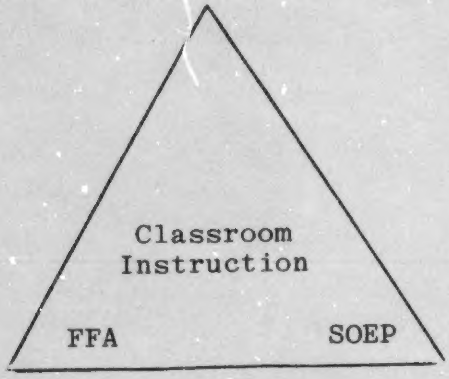
3. Any student who has not completed his/her assigned choice by the beginning of the next day's class will not be admitted to class until the choice is completed.

4. Any student causing a severe classroom disruption will be sent immediately to the Vice Principal.

VIII. Total Program Concept - Summary

A. Draw summary from student.

B. This vocational agriculture program has three parts (components):



In order to maximize the value of your election of vocational agriculture, you should participate in the entire program, not just the classroom instruction.

1. Classroom instruction accomplishes:

   a. presentation of new information about agriculture in:

      1. Soil Science
      2. Animal Science
      3. Plant Science (Crops Horticulture)
      4. Agricultural Economics
      5. Agricultural Mechanics
      6. Leadership Development

2. SOEP accomplishes:

   a. on-site job experience
   b. in-depth specialized technical agriculture learning
   c. specialization in one phase of agriculture
   d. development of working attitudes and habits

3. FFA accomplished:

   a. refinement and extension of classroom information
   b. travel and social experiences with agricultural industry
   c. development of verbal ability
   d. refinement of leadership skills
   e. community consciousness

Securing a Job

Instructor's Guide:

1. This unit is provided as an option unit to help students learn how to seek and apply for jobs.
2. Job seeking units may be provided in other school curriculum. If so, this unit may be omitted.
3. Information is provided on "Selecting Agricultural Education as a college major." Presently, there are many more Vocational Agriculture teaching jobs than Vocational Agriculture graduates. Here is an opportunity to provide information on Vocational Agriculture to freshmen through seniors. (Refer to Appendix G.)

Objectives:

Upon completion of this unit, the student will be able to:

1. Find jobs appropriate to their skill and knowledge base.
2. Apply for jobs.
3. Evaluate jobs.

Teaching Aids:

1. "Careers in Agriculture": Vocational Education Productions
California Polytechnic State Univ.
San Luis Obispo, California 93407
1-800-235-4146

8 filmstrips, cassettes, scripts
Total set: $234
Individual sets: $32.50

2. Human Relations in Agribusiness: Hillison/Crunkilton
Copyright 1980 McGraw-Hill, Inc.

Student Activities:

1. Develop a Personal Data Sheet or Resume.
2. Complete sample Job Application Blanks.
3. Participate in practice job interviews.
4. Complete a letter of application.

5. Compile a job file, emphasizing jobs of interest.

6. Complete a job conditions checklist.

References:

1. Book: "So You Are On Your Own": Oregon Department of Education
   Instruction Division
   Salem, Oregon 97310
   Information - 378-3569

2. Future magazine: "Seven Steps Towards Getting a Job" February 1958.

3. Cooperatives in Agribusiness, Report #5, U.S. Department of Missouri.

4. Book: "Agriculture Law," Donald Levi, University of Missouri.

5. Pamphlets:
    1. Planning a Profitable Farm Business.
    2. Sources of Farm Credit.
    3. Law for the Farmer.
    4. Setting up Farm Records to Provide for Analysis.

   University of Illinois, College of Agriculture

Introduction Ideas:

1. Invite the president or manager from a successful local business to serve as a guest speaker. They would relate to students what they look for and expect in hiring for jobs in their company.

2. Set up interviews with three to four people in the community. Prearrangements would be made with these people. The students would go individually or in pairs to interview with these people. Prearranged questions would be established with the interviewers.

Table of Contents:

1. Appendix A: Personal Inventory.

2. Appendix B: Personal Data Sheet or Resume.

3. Appendix C: Interview Record.

4. Appendix D: Letter of Application.

5. Appendix E: The Employment Application Cycle.

6. Appendix F. Job Conditions Checklist.

7. Appendix G: Materials on Selecting Agricultural Education as a College Major.

Securing a Job

I. Location of Job Prospects

  A. Newspaper.

  B. Radio.

  C. State Youth Employment Service.

  D. Friends and Acquaintances.

  E. Private Employment Agencies.

  F. Small Businesses.

  G. Large Businesses.

  H. New Construction.

  I. U.S. Civil Service.

  J. Plants and Factories.

  K. State Personnel Division.

II. Developing Personal Inventory (refer to Appendix A)

  A. Personal Evaluation - Questions to ask yourself.

    1. "What do you want to do?"

    2. "What can you do?"

    3. "How can your skills and abilities be most profitable to employers interested in you as a new employee?"

  B. Developing a detailed, realistic inventory.

    1. Your qualifications.

    2. Your interests.

    3. Your limitation.

    4. Includes basic information.

  C. When to utilize your Personal Inventory.

    1. Take with you whenever seeking employment.

    2. Handy reference for filling out applications for employment.

3. Job interviews.
4. Preparation of personal data sheet.

III. What Prospective Employers Want to Know

A. Personality.

B. How long you have lived in the given area.

C. Experience in line of work.

D. Attendance in school and or other jobs.

E. Technical skills.

F. Physical defects.

G. Character references.

H. Legal record.

I. Interests.

J. Reasons for wanting the job.

K. Personal qualifications.

1. Appearance.
2. Character.
3. Intelligence.
4. Dependability.
5. Attitude.

L. Personal Data Sheet (refer to Appendix B).

1. Prepare a personal data sheet.
    a. Usually only one page in length
    b. Refer to the more detailed inventory for more information needed
2. Several original copies should be typed.
3. Take it with you to each business at which you apply.
4. If sending a personal data sheet in the mail to a business firm, always send it with a letter of application for the position.

5. Give copies of personal data sheet to relatives, friends and acquaintances.

6. Send a copy of personal data sheet to everyone you intend to use as a reference with a letter requesting permission to use them as a reference.

7. Professional people in positions of authority provide a more meaningful reference.

8. Provide a good snapshot of yourself and staple it to upper left-hand corner of your Personal Data Sheet.

9. A good idea when you meet the personnel manager for your interview is to say something like this: "I am very sincere about wanting to work for your company, and I have taken time to prepare a personal data sheet for your convenience."

IV. How to Get Started

A. Purchase a pack of 3 x 5 cards and record prospects.

1. Name of company with job openings.
2. Address.
3. Phone.
4. Name of person to see.
5. Organize cards geographically.

B. Locate a city map.

C. Carry two (2) pens.

D. Carry Social Security Card (must have a S.S. number, if not, go to Social Security Office and apply for one.)

E. Take Personal Data Sheet(s) and Personal Inventory in a folder.

F. Never take anyone else with you.

G. Before leaving home, telephone each business you are planning to visit and ask if applications for employment are being accepted. If so, then ask the name of the person you should see about employment. Record this name on the appropriate 3 x 5 card. Make a mental note of names before you meet the appropriate people and use their names upon meeting them.

H. Be in the right frame of mind when applying - not moody or worried.

   1. Appear cheerful, alert, interested, and self-confident.

   2. Appearance - dress for the job you are seeking.

   3. Eye contact.

   4. Attitude.

   5. Smile.

I. Types of employment.

   1. Part-time employment.

      a. Canvass personally

   2. Full-time positions.

      a. Telephone first

J. Small Business Procedures.

   1. See owner or manager (ask clerk for name).

K. Large Business Procedures.

   1. Find out general information about the company.

      a. What it makes
      b. What it sells
      c. General background

   2. Resources of information in local library:

      a. Poors' Registered Directors and Executives
      b. Moody's Industries

         1) Size
         2) Nature
         3) Location
         4) Description of products
      c. Trade journals

   3. Obtain department head's name and see him or her.

L. Times to apply.

   1. Monday - Thursday, between opening of store or business to 12 noon or 1:00 p.m. - 4:30 p.m.

V. How to Apply

  A. Take two (2) pens - one as a spare.

  B. Carefully read and follow directions.

  C. When the date is asked for, put today's date, not the date you will be ready to begin work, such as "summer" or "October." Know the date or always carry a calendar.

  D. Be sure to put "today's date" and "Birthday" in the appropriate spaces.

  E. No question on the application blank is a foolish one; each one has a purpose.

  F. Read the entire application blank before writing anything.

  G. Use your head before asking questions about things that puzzle you.

  H. The way you complete an application indicates how you work.

    1. Neatness.

    2. Organization.

    3. Accuracy.

  I. Proofread carefully.

  J. Application blanks will vary as each company tailors the application blank to its own needs.

  K. Be sure to put answers in the approriate spaces or on the appropriate lines.

VI. The Interview (refer to Appendix C)

  A. Organize a small notebook.

    1. Jobs.

      a. List all the previous held jobs
      b. List jobs in order of when held
      c. List the time period held for each job
      d. List the pay received for each job
      e. List the tasks you performed for each job
      f. List why you left the job

    2. Name and address of each company.

    3. Name of past supervisor.

B. Dress

   1. Dress appropriately for the job you are seeking.
   2. Maintain good manners.

C. Thoroughly review personal data sheet.

D. Approach the interview with confidence.

E. While waiting for an interview:

   1. Sit erectly while waiting - don't smoke.
   2. Stand up as the interviewer approaches you, this shows respect and courtesy.
   3. Address the interviewer by his/her name.
   4. Offer the interviewer your portfolio, including the personal data sheets.

F. Never light a cigarette while being interviewed unless so invited.

G. Take a chair and be seated only when offered. Do not move that chair, it has been placed there for a reason.

H. Appearance.

   1. Personal cleanliness.
   2. Teeth brushed.
   3. Nails clean.
   4. Hair trimmed and combed.
   5. Young men: clean shaven (if you have a moustache or beard, be sure they are trimmed and neat).
   6. Young women: conservative make-up.
   7. Alert.
   8. Conservative clothes, clean and pressed.
   9. Good posture.
   10. Use proper English - avoid slang expressions.
   11. Honest answers.
   12. Do not immediately bring up salary or fringe benefits.

13. Place purse, briefcase, etc., on floor - never on the interviewers desk.

14. Do not do all of the talking.

15. Have a career objective.

16. Address the interviewer with respect.

17. Know something about the business and during the interview ask something about the business.

    a. Kinds of products and/or service it sells
    b. How large it is in its field
    c. Opportunities for advancement
    d. Kinds of work available

18. Never be too critical of a past employer.

19. At all times be positive.

    a. Don't criticize other companies you have worked for
    b. Be willing to work any shift they have and begin whenever they want you to start

20. Be specific in explaining what kind of job you want.

21. Give specific reasons why you want that particular job.

22. Before leaving, ask when you should check back.

23. If you come back for an appointment, be 15 minutes early.

24. If you don't get the job, the interviewer may offer you other prospects; have pencil ready and abbreviate so he/she doesn't have to repeat.

25. Watch for clues that the interview is over and leave quickly and courteously. Clues:

    a. Files resume
    b. Puts application to one side of desk
    c. States "glad that you came" or "will get in touch with you
    d. Pushes chair back and stands up
    e. Interruptions by secretary or buzzer may also be hints

26. After interview - evaluate.

27. Accept gracefully and profit from any constructive criticisms made of you by the interviewer.

28. Consider each interview a learning experience.

VII. The Follow-up

- A. Record date of interview and other pertinent information on 3 x 5 cards.
- B. Return to each prospect after one or two weeks.
- C. Ask for the person you spoke to on your first visit.
- D. Never take anyone with you.
- E. Take time to write a brief "thank you" letter to those who helped you.
- F. It may take several visits to get a job.
- G. Keep in touch with the employers so they will keep you in mind when an opening does occur.

VIII. Letter of Application (refer to Appendix D)

- A. When it should be used:
  - 1. For employment a great distance from the area in which you live.
  - 2. For businesses in which this is a customary procedure.
- B. What it should contain:
  - 1. Reason you are submitting this letter and enclosed resume.
    - a. Newspaper advertisement
    - b. Employment agency
    - c. Other
  - 2. A statement of your training goals, of how you might be of use to the employer and why you want to work for this company.
  - 3. A few general statements as to your qualifications.
- C. Letter should be typewritten or one page (keep one for your own file).
- D. The Personal Data Sheet should be on one or two separate pages.
- E. Do not state your need for the position.
- F. Use three or four well-thought-out paragraphs in the letter, each with two or four well-written sentences.

G. Time the arrival of the letter of application for the middle of the week, not on a hectic Monday or Friday.

IX. Characteristics of successful young people on their jobs

A. Perserverance.

B. Politeness.

C. Punctuality.

D. Interest.

E. Ambition.

F. Enthusiasm.

G. Dependability.

H. Good memory.

I. Neatness

J. Personal cleanliness.

K. Respect for authority.

L. Patience.

X. Nine ways to get the most out of your job

A. Low man on the Totem Pole.

1. Remember that you are a beginner - no work experience or status.

2. Be aware of trying to cover your inexperience with an imperious manner.

B. Inexperience gives you an advantage.

1. Make the most of the first few weeks of free advice, direct help and personal friendliness from the other employees.

2. But, don't presume on it.

C. You have to know what's going on.

1. Find out what you are suppose to do and how to do it.

2. Ask questions.

3. Don't be afraid to reveal your ignorance.

4. Learn your responsibilities quickly and well, as well as to why.

5. Know the rules, hours, sick leave, vacation, etc

6. Keep an eye on customs and traditions.

D. You earn your pay.

1. Most important habit you can acquire is "The habit of working at full capacity."

2. Don't cut corners.

3. Learn how to do a routine job well and to improve yourself while doing it.

E. People are human.

1. Learn how to get along with all kinds of people.

2. Learn how to be tactful - don't offend.

3. Don't try to win high regard through false flattery or by trying to be a nice guy.

4. Don't give vent to anger.

5. Don't play on sympathies of others for your personal problems.

6. Don't play practical jokes.

7. Don't ever tell a fellow employee straight out that he is a fool.

8. Be quick and willing to give credit where it is due.

9. Learn the use of friendly good humor.

F. You can earn while you learn.

1. Read brochures, sales copy, the president's report and any other reports that are made available to you.

2. Learn as much as you can about the company that you are working for.

    a. History
    b. Markets
    c. Products
    d. Internal organization
    3. Tour the plant

3. Don't probe for secrets.

4. Don't cross-examine people about other people.

5. Don't limit your chance for opportunities to learn.

G. There is an art to being bossed.

1. Learn the delicate and vital art of being supervised.

2. Learn how to accept directions and carry them out.

3. Learn to ask questions that are to the point.

4. Learn to receive criticism and how to improve upon it.

5. Cooperate if you are needed for extra work.

6. Don't take your personal problems to the boss.

7. Don't bypass the supervisor.

8. Be straightforward, clear and concise when talking business.

H. Chomping at the bit is risky.

1. More harm can be done by moving too fast too soon.

2. Do the job well on the job you are on.

3. Do more than is required of you on that particular job.

I. How are you doing?

1. Checklist:

   a. Do you fully understand what you are suppose to do?
   b. How do you rate yourself on your job?
   c. How are your relations with fellow workers?
   d. Have you been learning all that the job has to teach ycu?
   e. Where would you like to go from here?
   f. Which of your weakpoints will you need to strengthen?

XI. Ten ways to improve your position

A. Make your job resume brief and interesting.

B. Do your best to check out all appropriate opportunities.

C. Be specific when discussing job possibilities with an employer.

D. Seek a job that will tax you almost to the peak of your potential. Don't take on something you can't handle or settle for much less.

E. Remember the employer's self-interest. Discuss what you can contribute as well as what you want.

F. Do your homework before an interview.

G. Take the initiative during an interview if the employer doesn't lead the conversation.

H. Stress accomplishments, not chores at your last job.

I. Be bold about money. Remember, most employers have a pay range in mind. A few frank words may net you a substantial increase in salary.

J. Withhold acceptance of a job until you know the employer meets your approval.

APPENDIX A

PERSONAL INVENTORY
March 31, 1971

I. PERSONAL DATA

Name - Joseph O. Abbey

Address - 640 Center Street NE
Salem, OR 97303

Telephone Number - 363-1089

Date of birth - January 25, 1951

Place of birth - Salem, Oregon

Height - 5'10"

Weight - 162 lbs.

Physical handicaps - None

Days ill during past year - 2

Nature of illness - Cold

Number of brothers - 1, age 16

Number of sisters - 1, age 14

Father's occupation - Machinist

Father's education - High school, evening trade school, 3 years

Mother's education - High school, business school, 1 year

Marital status - Single

Hobbies - Music recordings, reading, fishing, hunting

Newspaper read regularly - *Capital Journal*

Magazines read regularly - *Reader's Digest*, *Time*, *Look*

Smoke - Yes, but not to excess

Drink alcoholic liquor - No

Personal assets - Good personal and business ideals; like people and get along well with them; a sense of humor; enjoy working and can concentrate well.

Personal hindrances - Realize necessity for experience and lack self-confidence in certain situations.

Ambition - To become a senior accountant, comptroller, public accountant, or auditor.

PERSONAL INVENTORY

II. EDUCATION

High School - North Salem High School

Course taken - Business, with major in bookkeeping

Subjects - English, 4 years
Arithmetic, 1/2 year
History, 1 year
Economics, 1 year
Economic Geography, 1 year
Biology, 1 year
Salesmanship, 1 year
Bookkeeping, 2 years
Business Law, 1/2 year
Typewriting, 1 year

Subject in which best work was done - Bookkeeping

Subject in which poorest work was done - Biology

Standing in class - Second fifth of class

Student activities in high school - Basketball, 2 years
Reporter, school paper, 1 year
Member, Music Club, 3 years

Attendance in school - Missed five days in junior year, perfect attendance otherwise, never tardy to a class.

- - - - - - - - - - -

Business School - Merritt Davis College, 1 year

Subjects - Accounting, 1 year
Business Mathematics, 1/2 year
Business Law, 1/2 year
Business Organization, 1 year
Economics, 1 year

Subject in which best work was done - Accounting

Student activities in business school - Vice-President of class
President of Music Club

- - - - - - - - - - -

Skills - Can keep a complete set of books, including the preparation of financial statements; can typewrite 55 words a minute; can cut stencils and operate mimeograph and duplicating machines.

PERSONAL INVENTORY

III. EXPERIENCE

Clerical assistant, mail order department, Sears Roebuck and Company, two summers;

Clerk, bookkeeping assistant, Cox Company, one summer.

IV. REFERENCES

Mr. A. Arthur Mandell, Head, Mail Order Department, Sears Roebuck & Company

Mr. Alexander Cox, President, Cox Company

Mr. Bernard Jameson, Bookkeeping Department, Jordan Marsh Company

Mr. Joseph Dane, Assistant Director, High School Business Department

Mr. Edward Tapper, Instructor in Accounting, Merritt Davis College

Appendix B

PERSONAL DATA SHEET OR RESUME

NAME: Sarah Grammer AGE: 18 PHONE: CA 3-1873

ADDRESS: 1722 SW Market Street, Portland, Oregon 97201

SOCIAL SECURITY NUMBER: 544-48-4401 BIRTHDATE: March 28, 1948

HEIGHT: 5'9" WEIGHT: 125 pounds SEX: Female

MARITAL STATUS: Single HEALTH: Excellent

EDUCATIONAL BACKGROUND, DEGREES, CERTIFICATES, ETC.:
Lincoln High School, 1600 SW Salmon Street, Portland, Oregon
Shattuck Grade School, Portland, Oregon
Bookkeeping Certificate of Proficiency, Lincoln High School

EXTRACURRICULAR ACTIVITIES:
Girls League
Pep Club

SPECIAL SKILLS AND APTITUDES:
Course of filing, push button telephone; office machines as follows:
Selectric, Rotary Calculator, Full Keyboard, Manual Typewriter, Duplicator and Mimeograph.

COMMUNITY ACTIVITIES:
Southern Baptist Church
Shattuck Grade School Swimming Team
First Aid Course

PREVIOUS EMPLOYMENT:
Lincoln High School, 1600 SW Salmon, Portland, Oregon 97205
(typing and filing)
Lincoln High School, 1600 SW Salmon, Portland, Oregon 97205
(custodial work during summer)
General babysitting
Summer employment: Berry picking
Bean picking

REFERENCES:

Mr. Gerald Leadham
Lincoln High School
1600 Salmon Street
Portland, Oregon 97205

Mr. Charles Probert
Lincoln High School
1600 Salmon Street
Portland, Oregon 97205

Mrs. George Belnap
7527 SW Martins
Portland, Oregon 97205

Mrs. Ida McFarren
10330 NE Cornell Road
Portland, Oregon 97205

Appendix C

INTERVIEW RECORD

Applicant____ Date___________

Position____

QUALITY RATING

Characteristics	Fair	Good	Very Good	Superior
Appearance				
Education				
Experience				
Personality				
Oral Expression				
Initiative				
Judgement				
Maturity				
Growth Potential				
Sales Ability				

Additional Comments:

NOTE: This is an example of a typical interview record made by the interviewer of Job Applicant.

Appendix D

Example of Letter of Application

43 Broad Street
Yourtown, U.S.A.
November 28, 1971

Mr. John Doe
Employment Manager
The ABC Company
182 Main Street
Yourtown, U.S.A.

Dear Mr. Doe:

Please consider this letter an application for a stenographic position in your downtown office.

Last June I graduated from Yourtown High School, after completing a three-year commercial course. My typing and shorthand speeds are 70 and 100 words per minute, respectively.

A record of my high school courses, grades, and previous work experience is included on the attached data sheet. Although I have been employed only during school vacation periods, I have a genuine liking for office work. If given an opportunity, I will work hard to prove myself an asset to your company.

I would appreciate the opportunity to come in and talk over this matter with you at your convenience. I may be reached at the above address or by telephone, Plaza 2-7308.

Cordially,

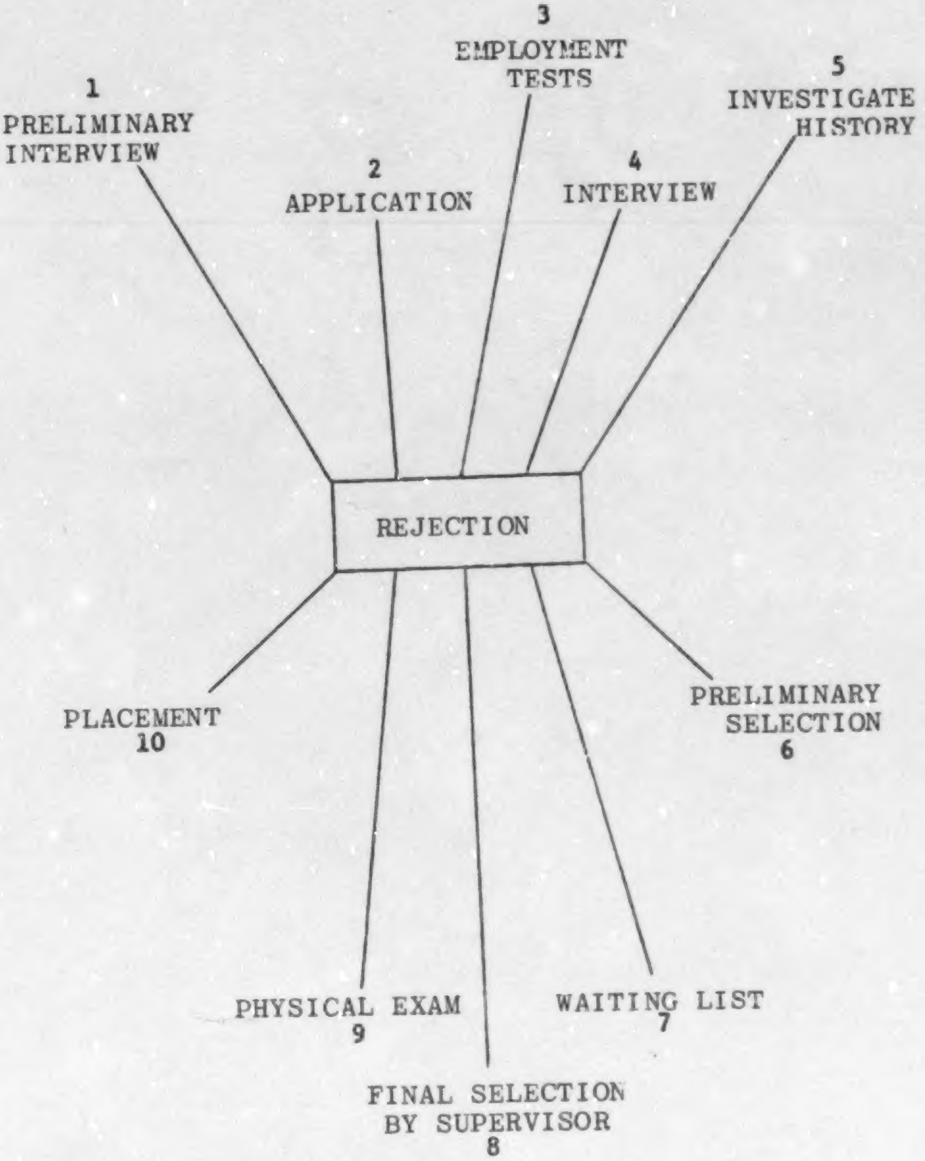
Your name

Appendix E

THE EMPLOYMENT APPLICATION CYCLE

NOTE: An applicant for any position will go through some, and frequently all, of these basic steps in his or her effort to obtain a work position.

At any stage of the cycle, however, one may be either eliminated or hired without progressing any further.


1
PRELIMINARY INTERVIEW
2
APPLICATION
3
EMPLOYMENT TESTS
4
INTERVIEW
5
INVESTIGATE HISTORY
REJECTION
PRELIMINARY SELECTION
6
WAITING LIST
7
FINAL SELECTION BY SUPERVISOR
8
PHYSICAL EXAM
9
PLACEMENT
10

Appendix F

JOB CONDITIONS CHECKLIST
(Thomas Hamilton Study as basis)

Place a number 1 if the item is not at all important to you and a number 2 if it is only of some importance to you. If the item is in the middle of importance to you, place a 3 by it, and if it is very important to you place a 4 or even 5 in the provided space.

1. A job that means I'm looked up to by other people ____
2. Interesting work ____
3. Easy work ____
4. Pleasant working conditions ____
5. A chance to do things my own way--make my own decisions ____
6. A good boss ____
7. A chance to be in charge of things ____
8. Medical insurance and life insurance paid by the company ____
9. Variety in the job--different kinds of work ____
10. A chance to be useful to society ____
11. A chance to see what I can do--how good I am ____
12. A good place to live ____
13. A good retirement plan ____
14. Good vacations ____
15. Short working hours ____
16. Steady work ____
17. A chance to direct or supervise others ____
18. Good pay ____
19. A chance to move up in the world ____
20. Good chances for promotion or advancement ____
21. Good people to work with ____
22. A job where you have to be good to handle it ____
23. A chance to work by myself without a lot of other people there ____
24. A chance to help other people ____
25. A chance to try other things and see how I like them ____
26. A chance to be outside part of the time ____

Appendix G

MATERIALS ON SELECTING AGRICULTURAL EDUCATION AS A COLLEGE MAJOR

Background and Purpose:

Deciding to go to college and selecting a major are important events in the lives of the young people we teach. Each of you, as a vocational agriculture teacher, made that decision -- to go to college -- and you selected agricultural education as a major.

The purpose of these materials is not to provide all the information your students need about these decisions. Rather, the purpose is much more specific -- to give students information about AGRICULTURAL EDUCATION and to interest them in this major.

Other departments in the universities across the state will be more than willing to provide you with information about their majors. Obviously, those of us in departments of agricultural education believe that AGRICULTURAL EDUCATION is a good major, whether a student intends to teach vocational agriculture or not. In fact, about as many of our graduates do not teach as do teach. So, another message that these materials try to emphasize is that AGRICULTURAL EDUCATION prepares a student for much more than teaching. At the same time, we point out that the preparation of vocational agriculture teachers is our unique role; no other program can qualify a person to be a teacher of vocational agriculture.

Suggestions:

The materials are not designed as a single lesson plan or unit. Rather, they are designed to be used at your discretion. Hopefully you will be able to provide some basic information to all of your vocational agriculture students about AGRICULTURAL EDUCATION. Perhaps this should be done as a part of a unit on careers in agriculture; more specifically, you may have a particular lesson on preparing for professional careers in agriculture.

Realistically, however, all of your students are not college bound. So, you may want to identify those students who you believe are potential college students. (Don't "discount" or overlook some students who are not high achievers. Possibly, they are "late bloomers.") For the identified students you may want to provide the check sheets, inventories, and worksheets. You should provide small group or individualized instruction to assist them in completing the materials. Then, follow up by reviewing the materials and by counseling with those students who need your assistance.

Finally, you may want to be selective on which materials you use with which students. For example, the "puzzle" activities are probably more appropriate for younger students. On the other hand, the checklist for plans after high school may be more applicable to juniors or seniors.

Additional Instructional Activities:

1. Invite an AGRICULTURAL EDUCATION graduate, a staff member from a university department of agricultural education and/or a student presently enrolled in agricultural education to speak to your class(es).

2. Have students write various departments of agricultural education for additional information.

3. Attend college career days, and require students to write a brief summary of the information they gathered.

4. Have students interview and tape record agricultural education graduates in the community. (Possibilities are former vocational agriculture teachers, county extension agents, agricultural sales representatives, agricultural business operators and managers, farmers, ranchers, farm and ranch managers, PCA, FLB, FmHA, SCS, and ASCS employees, and agricultural representatives in banks or savings and loan associations.

5. Have students prepare a bulletin board explaining and promoting agricultural education. Locating on a map those universities that offer agricultural education, depicting career opportunities for agricultural education graduates, or explaining course work are examples of themes to highlight in a bulletin board.

6. Relate some of your own reasons for majoring in agricultural education.

7. If firms are available, have students call to see what kind of college graduates the business will hire. (Students can simply identify themselves as a prospective college student trying to choose a major in agriculture, and they are conducting a telephone survey of prospective employers for the future.

Other Activities:

1. Provide names of potential students to departments of agricultural education in universities. (Even students who plan to go to a junior college can be contacted by faculty in agricultural education).

2. Work with guidance personnel and parents to interest prospective students in agricultural education, to assist in filling out applications for admission, and to locate and apply for financial assistance.

3. Follow up students who enter college. Check on their progress, and get their suggestions for improving the vocational agriculture program for college-bound students. (But remember that the majority of your students will not go on to college.)

4. Provide classroom "enrichment" activities for superior students. Reviewing your notes, reading your textbooks, doing "homework" assignments from your college courses may be possible "enrichment" activities.

AGRICULTURAL EDUCATION WORD SEARCH

Sometimes in making decisions, we "cannot see the forest because of the trees." There are several "trees" in the "forest" below. See if you can find the words from the words CAPITALIZED, underlined from the passage below in the "forest" of letters. The words apply to AGRICULTURAL EDUCATION. After you have circled these words, see if you can identify another message embedded in the letters.

Here is the passage:
Agricultural education involved both the study of PEOPLE and of SCIENCE. The science involved in agricultural education deals with ANIMALS, CROPS, MECHANICS, and ECONOMICS. The study of people will help you APPLY the science in the BUSINESS world. To get a DEGREE in agricultural education, you must maintain good GRADES in high school. In turn, a COLLEGE degree in agricultural education will enable you to get a good JOB. The degree allows you to DO many things. For example, graduates can TEACH, go into agricultural SALES, or perhaps work for an agency such as PCA. Most jobs will earn you a good SALARY. Perhaps best of all, however, you will be satisfied if you like to work with people in agriculture.

Hint: The words may be written FORWARD, DRAWKCAB, V   Y,U
E   L   P
R   L
T   A   O
I   N   R
C   O
A   G   D
L   A   O
L   I   W
Y,D   N

B W T P D B N A Z X Q V W V N M B R O E C D E O

Y F D L T U Z S R B L X M A V N C P E O P L E T

R B Z G P D L R C M X L B R Z S O V P N C R D G

N N S Q T A Q V B I O A Q X O A L B G J H K D D

A M L R M H T R V L E F Y T V Z L P N R Q D B T

K P V I A B I L I T Y N J Q G F E Q H P C A J T

O S N R Z A X T B V M G C D T T G J R N H W O M

S A V H M Y E O X L A F N E H R E C R O P S B R

N A Q J N X L Q T D E S B O I N X P S T L Q Z G

O T L D J B H J Q B Z F N R M T Z B D R R E F N

S M S A L A R Y D S R R H N G E E R G E D B N Y

P E D W R B J X T F Z A S N M C W N W J H O F C

N C P U F G N L X V Q L Y J L O H J Z Q S G R H

T H Z R C D V I B T L R V R S N W A N L Z R M G

U A T E A C H Y Q B M M D C R O H N O A E A T R

L N J R B M N V W Q X Z A N B M J D P X T D N J

L I V A M X L B R S Z U T L D I Z F Y B T E I H

Q C N B N E G R E B D R F E L C Q T S D T S O K

G S S E N I S U B Z V T Y E R S S A L E S B B J

O E D C E O R B M N V W Q X Z A N B D P T W Q V

What is the "hidden message" visible when you have circled the letters?

B	W	T	P	D	B	N	A	Z	X	Q	V	W	V	N	M	B	R	O	E	C	D	E	O
Y	F	D	L	T	U	Z	S	R	B	L	X	M	A	V	N	C	P	E	O	P	L	E	T
R	B	Z	G	P	D	L	R	C	M	X	L	B	R	Z	S	O	V	P	N	C	R	D	G
N	N	S	Q	T	A	Q	V	B	I	O	A	Q	X	O	A	L	B	G	J	H	K	D	D
A	M	L	R	M	H	T	R	V	L	E	F	Y	T	V	Z	L	P	N	R	Q	D	B	T
K	P	V	I	A	B	I	L	I	T	Y	N	J	Q	G	F	E	Q	H	P	C	A	J	T
O	S	N	R	Z	A	X	T	B	V	M	G	C	D	T	T	G	J	R	N	H	W	O	M
S	A	V	H	M	Y	E	O	X	L	A	F	N	E	H	R	E	C	R	O	P	S	B	R
N	A	Q	J	N	X	L	Q	T	D	E	S	B	O	I	N	X	P	S	T	L	Q	Z	G
O	T	L	D	J	B	H	J	Q	B	Z	F	N	R	M	T	Z	B	D	R	R	E	F	N
S	M	S	A	L	A	R	Y	D	S	R	R	H	N	G	E	E	R	G	E	D	B	N	Y
P	E	D	W	R	B	J	X	T	F	Z	A	S	N	M	C	W	N	W	J	H	O	F	C
N	C	P	U	F	G	N	L	X	V	Q	L	Y	J	L	O	H	J	Z	Q	S	G	R	H
T	H	Z	R	C	O	V	I	B	T	L	R	V	R	S	N	W	A	N	L	Z	R	M	G
U	A	T	E	A	C	H	Y	Q	B	M	M	D	C	R	O	H	N	O	A	E	A	T	R
L	N	J	R	B	M	N	V	W	Q	X	Z	A	N	B	M	J	D	P	X	T	D	N	J
L	I	V	A	M	X	L	B	R	S	Z	U	T	L	D	I	Z	F	Y	B	T	E	I	H
Q	C	N	B	N	E	G	R	E	B	D	R	F	E	L	C	Q	T	S	D	T	S	O	K
G	S	S	E	N	I	S	U	B	Z	V	T	Y	E	R	S	S	A	L	E	S	B	B	J
O	E	D	C	E	O	R	B	M	N	V	W	Q	X	Z	A	N	B	D	P	T	W	Q	V

What is the "hidden message" visible when you have circled the letters?

AG ED !

Ag IV - I - 35

AGRICULTURAL EDUCATION
CROSSWORD PUZZLE

Are you somewhat puzzled or unsure of what you want to do when you get out of high school? To help you in making decisions, you need practice in finding answers and in decision-making. Work the crossword puzzle as an example of an exercise in answering questions, solving problems, and making decisions.

By the way, the information in this crossword puzzle deals with one possible answer to your questions about what to do after high school. Your vocational agriculture teacher has additional information about AGRICULTURAL EDUCATION. Ask for it -- after you have completed this exercise correctly!

ACROSS

2 When you should begin planning what you will do after high school

3 An area of agriculture, often involving work in the shop

7 One of the jobs for which you are qualified if you major in AGRICULTURAL EDUCATION

12 An important result of working; your pay

13 The meat from swine; what you can buy with your answer for 12 across

15 A result of the amount of effort you exert; an indication of how much you have learned

16 An area of agriculture involving living things that are immobile

18 One way to learn, esp., on your own; what you do to a book

20 The correct name for the naturally occurring plant growth medium, often incorrectly called dirt

21 A career area for which you may qualify with a degree in AGRICULTURAL EDUCATION (an abbreviation for Public Relations

22 A way to learn, used when someone else is talking

24 Perhaps the best way to learn; part of the FFA motto

27 Abbreviation for Production Credit Association (another potential employer of AGRICULTURAL EDUCATION graduates

29 Of or pertaining to agriculture (the adjective form of agriculture

30 the sum of all you learn; a necessity for many jobs

DOWN

1 What you would do as a sales representative, one possible career for you as an AGRICULTURAL EDUCATION major

4 The accumulation of things that you have actually done

5 How to get answers for questions you may have about AGRICULTURAL EDUCATION

6 One way to learn, often hard work but a necessity to AGRICULTURAL EDUCATION majors

8 Where you must go to get a degree in

9 One result of an education; the "work or position" you will get when you finish a degree in AGRICULTURAL EDUCATION

10 To yourself, the most important person in making a career decision

11 A government agency that may employ AGRICULTURAL EDUCATION GRADUATES (abbreviation for the federal department dealing with agriculture)

12 Things you like to do; important considerations in choosing a college major.

14 "College is the _____ to success." Also what you drive on

17 Another area of agriculture, includes livestock, etc.

19 Your primary area of study in college; AGRICULTURAL EDUCATION is one example. Also a military rank just above a captain

23 An exercise that helps you prepare for the future; an intention; what you hope to do

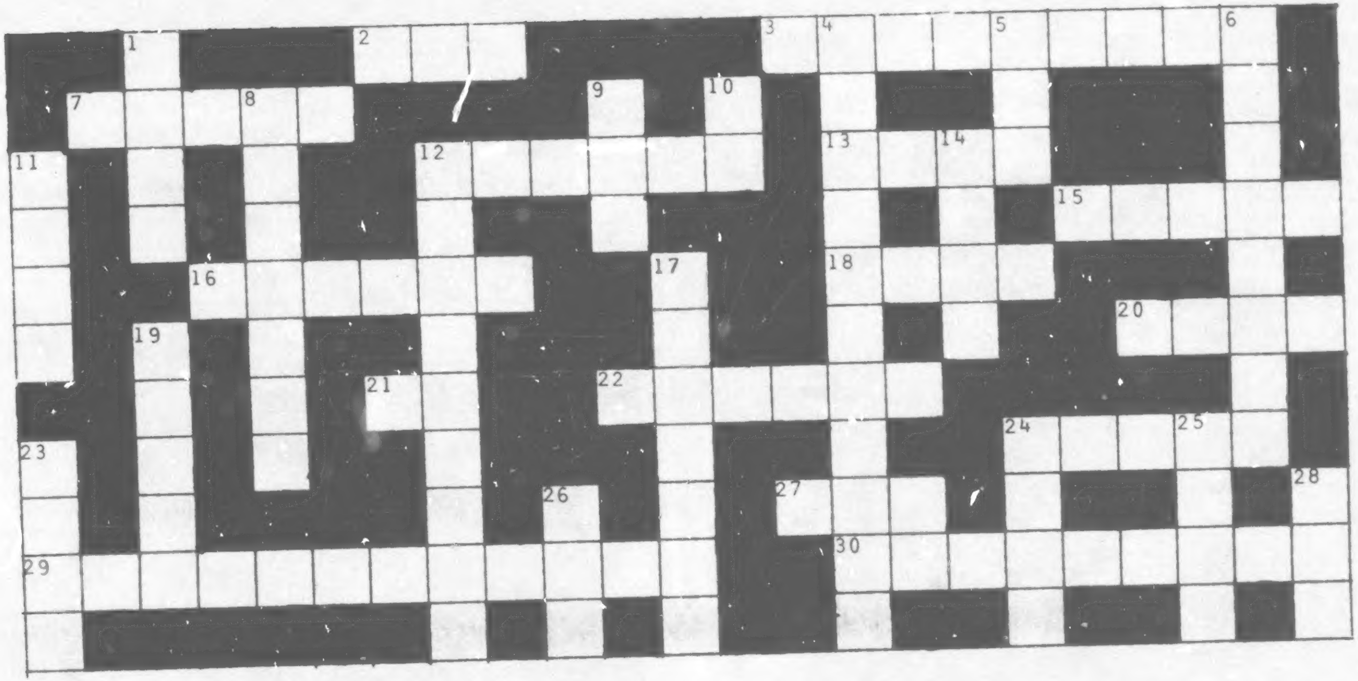
24 A procedure used in sheep production--to remove the tail.

25 A sharp object driven with a hammer

26 When you attempt to do something; for example, AGRICULTURAL EDUCATION: _____ it, you'll like it!

28 Needed in a pen to write. What you need to write for information about AGRICULTURAL EDUCATION

EST COPY AVAILABLE


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30

Ag IV - I - 37

KEY!

■	■	1 S	■	■	■	2 N	O	W	■	■	■	■	3 M	4 E	C	H	5 A	N	I	C	6 S	■
■	7 T	E	A	8 C	H	■	■	■	■	9 J	■	10 M	■	X	■	■	S	■	■	■	T	■
11 U	■	L	■	O	■	■	12 I	N	C	O	M	E	■	13 P	O	14 R	K	■	■	■	U	■
S	■	L	■	L	■	■	N	■	■	B	■	■	■	E	■	O	■	15 G	R	A	D	E
D	■	■	16 P	L	A	N	T	S	■	■	17 A	■	■	18 R	E	A	D	■	■	■	Y	■
A	■	19 M	■	E	■	■	E	■	■	■	N	■	■	I	■	D	■	■	20 S	O	I	L
■	■	A	■	G	■	21	R	■	■	22 L	I	S	T	E	N	■	■	■	■	■	N	■
23 P	■	J	■	E	■	■	E	■	■	■	M	■	■	N	■	■	24 D	O	I	25 N	G	■
L	■	O	■	■	■	■	S	■	26 T	■	A	■	27 P	C	A	■	O	■	■	A	■	28 I
29 A	G	R	I	C	U	L	T	U	R	A	L	■	■	30 E	D	U	C	A	T	I	O	N
N	■	■	■	■	■	■	S	■	Y	■	S	■	■	S	■	■	K	■	■	L	■	K

Ag IV - I - 38

BEST COPY AVAILABLE

EXPERIENCE, INTEREST, AND NEED SURVEY

PART I

1. Do you like working with people?

_____ Yes _____ No

2. Do you like working with many phases of agriculture?

_____ Yes _____ No

If you answered YES to the two questions above, you may be a "candidate" for a major in AGRICULTURAL EDUCATION. Go on to PART II.

PART II

The basic technical area in agricultural education is, of course, agriculture. So, let's take a look at (1) your experiences, (2) your interests, and (3) your needs in the field of agriculture. Use the following "code" to complete the checklist:

"E" - means that you have experience in this area of agriculture.
"I" - means that you have an interest in this area of agriculture.
"N" - means that you need or want to learn more in this area of agriculture.

You may use one, two, or all three of the "codes" for each of the following areas of agriculture.

Agricultural Mechanics

_________ Hand Tool Use and Care
_________ Tool Conditioning
_________ Machinery Set-up
_________ Tractor Maintenance
_________ Engine Overhaul
_________ Machinery Operation
_________ Equipment Repair
_________ Electricity
_________ Agricultural Facilities
_________ Metal Construction
_________ Wood Construction
_________ Small Gasoline Engines

Agricultural Economics/Business

_________ Record Keeping
_________ Farm Management
_________ Inventorying
_________ Depreciation
_________ Record Analysis
_________ Marketing
_________ Futures Marketing
_________ Agricultural Sales
_________ Income Tax
_________ Machinery Management
_________ Credit
_________ Money Management

Agricultural Mechanics (Cont.)

__________ Arc Welding

__________ Oxy-actylene welding & cutting

__________ Plumbing

__________ Irrigation

__________ Safety

__________ Equipment Reconditioning

Animal Sciences

__________ Beef Cattle

__________ Swine

__________ Sheep

__________ Goats

__________ Dairy Cattle

__________ Horses

__________ Poultry

__________ Small Animals

__________ Wild Game

__________ Animal Health

__________ Feeds and Feeding

__________ Animal Nutrition

__________ Animal Breeding

__________ Animal Reproduction

__________ Livestock Selection

__________ Livestock Judging

__________ Meats

__________ Fish and Seafood

Agricultural Economics/Business (Co)

__________ Types of Loans

__________ Figuring Interest

__________ Business Forms

__________ Business Machines

__________ Produce Display

__________ Pricing

Agronomic Sciences

__________ Grain Sorghum

__________ Cotton

__________ Rice

__________ Wheat

__________ Soybeans

__________ Oats

__________ Small Grains

__________ Hay

__________ Pastures

__________ Plant Identification

__________ Soil Management

__________ Land Judging

__________ Fertilizers

__________ Plant Breeding

__________ Seed Identification

__________ Seed Selection

__________ Crop Harvesting

__________ Forestry

Horticulture/Floriculture

__________ Vegetable Production
__________ Gardening
__________ Lawn & Turf Management
__________ Lawn Care
__________ Landscaping
__________ Ornamental Plant Ident.
__________ Plant Propagation
__________ Tree Fruit Production
__________ Small Fruit Production
__________ Citrus Fruits
__________ Flower Production
__________ Floral Design
__________ Shrubs and Trees
__________ Greenhouse Operation
__________ Pest Control
__________ Nursery Operation
__________ Plant Growth Media
__________ Fruit and Vegetable Processing

Other Technical Skills and Subjects

__________ Parliamentary Procedures
__________ Public Speaking
__________ Extemporaneous Speaking
__________ Skill Demonstration
__________ Outdoor Recreation
__________ Committee Organization
__________ Leadership
__________ Environmental Protection
__________ Energy Conservation
__________ Public Relations
__________ Communications
__________ Broadcasting
__________ Agricultural Exhibits
__________ Agricultural Promotion
__________ Career Planning
__________ Computers in Agriculture
__________ Decision-Making
__________ Agricultural Research

Now, let's total up your experiences, interests, and needs in agriculture.

______ = total number of "E's"
______ = total number of "I's"
______ = total number of "N's"

If you have (1) experiences in agriculture, (2) interests in agriculture, and (3) needs or a desire to learn more in agriculture, then you are the kind of person we want in AGRICULTURAL EDUCATION. Because AGRICULTURAL EDUCATION includes all phases of agriculture, people are needed who have experiences and interests in a broad range of agricultural subjects and who want to learn more in agriculture.

Discuss this checklist with your vocational agriculture teacher, your parents, your employer, other adults, and/or college students. Ask your vocational agriculture teacher how you can get more information about AGRICULTURAL EDUCATION.

PLANS AFTER HIGH SCHOOL*

YES NO

___ ___ Do you plan to get additional education after high school?

Do you plan to:

___ ___ Go to work for someone after high school?

___ ___ Work for yourself as a farmer, rancher, or business owner?

___ ___ Join the military service?

___ ___ Go to a technical school?

___ ___ Go to a junior college?

___ ___ Go to a 4-year college or university?

Write a brief report of your plans after graduation from high school. Be specific!

____

____

____

____

____

___ ___ Have you discussed your plans with your parents or guardians?

___ ___ Have you discussed your plans with a teacher, a counselor, or some other adult, such as your employer?

___ ___ Have you discussed your plans with a friend or friends?

*If you don't have any plans after high school, NOW is the time to start making them. So, DO THIS EXERCISE!

PREPARATION FOR COLLEGE

YES	NO	
___	___	Will you graduate from high school with a good academic record?
___	___	Have you taken or will you take the Scholastic Aptitude Test (SAT) or the American College Test (ACT)?
___	___	Do you have a Social Security Number?
___	___	Have you taken or will you take coursesin English, social science, mathematics, and science in addition to other courses?
___	___	Have you chosen a college or university to attend?
___	___	Have you discussed attending college with your parents or quardians?
___	___	Have you worked with your vocational agriculture teacher and/or guidance counselor to apply for admission?*
___	___	Have you visited or will you visit the campus of the college you plan to attend?
___	___	Have you chosen a "major" in college? If so, what is it? ______________________________.**

* If you are unsure about attending college or what college to attend, the best policy is to make application anyway. That way, if you do decide to attend, you will have the necessary paper work done. If you wait too late, you may not be admitted at all!

**If you have not chosen a major or you are undecided about your major, visit with your vocational agriculture teacher, your guidance counselor, your parents, other adults, your friends, and present college students about a major. However, don't be discouraged if you are still undecided even after visiting with all of these people. Many college students change their majors.

AGRICULTURAL EDUCATION

INFORMATION SHEET

Agricultural education is a curriculum that prepares people for professional careers in agriculture. The primary aim of agricultural education is to equip graduates with the knowledge and skills necessary to work effectively with people in agricultural occupations. Career opportunities are many. Graduates become vocational agriculture teachers, county agricultural or 4-H agents, farmers or ranchers, agribusiness employees, government service workers, and professional farm or ranch managers. Some graduates teach for a few years and then discover that their experience has helped to prepare them for other employment in agriculture.

The agricultural education curriculum prepares you for a professional career in agriculture by building on your past experiences. Many activities in which you have already participated should be helpful in completing a degree in agricultural education and in your future career. Studying vocational agriculture, participating in 4-H and/or FFA activities, growing up on a ranch or farm, and working in an agribusiness or on a farm or ranch are all examples of valuable experiences that can help you in your major in agricultural education.

The agricultural education curriculum combines classroom study with planned "hands-on" experiences to help prepare you to work with people in agriculture. The curriculum consists of 1) general education requirements, 2) scientific agriculture courses, and 3) professional education courses. General education requirements include courses such as English, biology, history, mathematics, government, and chemistry. These requirements generally apply to all degree programs in agriculture.

Scientific agriculture courses provide specific knowledge about agriculture. Students must take courses in animal science, agronomy, agricultural economics, and agricultural mechanics or engineering. Also, you may elect to take courses in horticulture, poultry science, entomology, and other areas of agriculture.

Professional education courses are designed to provide you with theories, techniques, methods, and experiences in working with people. Emphasis is placedon working with agricultural audiences and using agricultural knowledge and skills in various settings. The professional sequence of people-oriented courses culminates in an opportunity to try your skill as a student teacher in an Oregon high school under the leadership of an experienced vocational agriculture teacher.

The "bottom line" in agricultural education is that you will learn how to work with people involved in agriculture. The curriculum is broad-based, with courses in several areas of agriculture. So, you will be qualified for a wide variety of jobs. And, since you will know how to deal with people, you will have an additional advantage in searching for a job in agriculture.

AGRICULTURAL EDUCATION

Examples of Courses You Will Take in College

General Education

English
Journalism
Speech
Literature
American History
American Government
Physical Education
Political Science
Computer Science
Biology
Zoology
Botany
Chemistry
Mathematics

Technical Agriculture

Agronomy
- Crop Production
- Soils & Soil Conservation
- Forage, Pasture, and/or Range Management
- Plant Breeding/Seed Production
- Soil Fertility and Fertilizers
- Chemical Weed Control

Agricultural Mechanics/Engineering
- Agricultural Construction
- Welding and Cutting
- Farm Shop
- Irrigation
- Surveying
- Tractor Repair and Overhaul

Horticulture
- Ornamental Horticulture
- Flowers and Plants in Interior Design
- Landscape Plant Materials
- Plant Propagation
- Fruit and/or Vegetable Production
- Greenhouse Management

Animal Science
- Basic Animal Science
- Animal Nutrition
- Feeds and Feeding
- Animal Reproduction & Breeding
- Livestock Selection & Judging
- Beef, Swine, Sheep Production
- Meats and/or Meat Science

Agricultural Economics
- Marketing
- Farm and Ranch Management
- Agricultural Law
- Agricultural Cooperatives
- Land Economics and Appraisal
- Commodity Futures

Other Agriculture Courses
- Entomology
- Poultry Science
- Dairy Science
- Ecology
- Wildlife Science
- Fisheries Science
- Recreation and Parks
- Forestry

Professional Education

- Educational Psychology
- Secondary School Curriculum
- Advising the FFA
- Supervising SOE Programs
- Planning and Organizing Vocational Agriculture
- Teaching Adults in Agriculture
- Methods of Teaching Vocational Agriculture
- Student Teaching in Vocational Agriculture

Obviously, in four years of college, you could not possibly take all of these courses. Typically, you would enroll in five or six courses each quarter. So, in twelve quarters (four years), you would probably take sixty of the courses listed above.

Irrigation

Instructor's Guide:

1. It is recommended that the AAVIM materials on Irrigation be the basis for this unit.
2. It is further recommended that irrigation company representatives from the local area be consulted and asked to provide guest lectures and/or demonstrations.
3. Since the AAVIM materials are copyrighted you must buy your classroom materials from AAVIM. Purchase "Planning For An Irrigation System," at the following address:

   Extension Stock Room
   Extension Hall
   Oregon State University
   Corvallis, Oregon 97331

4. It is suggested that the entire book be covered in the time provided. However, use what is important to your area only.
5. This unit is a general unit on irrigation. It is suggested that you get together with a local irrigation dealer to develop an additional unit outline on maintenance of irrigation systems common to your area.

Objectives:

Upon completion of this unit the student will be able to:

1. Determine the effect of irrigation on crop production.
2. Determine how much water will be needed.
3. Identify satisfactory sources of water (quantity and quality).
4. Select a water application method most appropriate to topography, soil, and crop.
5. Determine irrigation cost and return on investment.

Teaching Aids:

1. Planning For An Irrigation System, 1980 edition, AAVIM.
2. Planning For An Irrigation System, slide set, AAVIM.

Student Activities:

1. Observe the slide set on Planning for an Irrigation System.
2. Observe and/or assist a local farmer in installing an irrigation system.
3. Develop an irrigation system for their own farm or for a hypothetical farm, incorporating the criteria included in this unit.
4. Student Presentations: Divide students into groups of two or three and have each group make a presentation on each of the five objectives.

References:

1. Planning For An Irrigation System, 1980 edition, AAVIM.
2. Planning For An Irrigation System, slide set, AAVIM.

Introduction Ideas:

1. Slide set presentation on Planning for an Irrigation System.
2. Invite guest speakers: local irrigation dealer
   local farmer who just has, or is in the process of putting in an irrigation system.

Irrigation

I. Determining the effects of Irrigation on Crop Production.

A. Four factors to consider when determining the effect of irrigation on Crop Production:

1. Effect of amount and timeliness of rainfall.

2. Effect of additional water.

3. Effect of land capability limitations.

4. Effect of fringe benefits from irrigation.

B. Effect of amount and timeliness of rainfall (refer to page 6 in Planning For An Irrigation System).

1. Location situations determine amounts of rainfall.

a. Depending on where you live, irrigation may or may not be an essential element to your farming operation
b. Arid locations require irrigation for the production of all crops
c. Semi-arid, sub-humid and humid locations will find irrigation of lesser importance

2. Timeliness of rainfall.

a. In many situations, even humid areas must be irrigated
b. Rainfall does not occur at the appropriate time for the crops
c. Time period between rainfalls is too long and crops will suffer

C. Effect of additional water (refer to page 8 in Planning For An Irrigation System).

1. The purpose of irrigation is to increase crop yields as well as crop quality.

2. If an ample water supply is available to the plant at the needed time, continued growth will occur.

3. Considerations before deciding to irrigate:

a. How much increase in yields can be expected if more water is available
b. Consider the climate conditions, soil type and crop varieties
c. Consult experiment stations, local agriculture agencies, as well as neighbors

4. Reasons for yield increases with ample water.
    a. Better assurance of a good stand
        1. Enough water must be present in the seed bed
        2. Irrigation is helpful in insuring a good stand of transplanted crops
            a. Water settles soil around the plant roots
            b. Prevents roots from drying out
    b. More plants per acre may be grown
        1. More water is available to support plant growth
    c. More efficient use of fertilizer
        1. Can fertilize heavily if plenty of water is available
        2. Water dissolves the fertilizer and makes it more available to the plants
    d. Plant improved varieties which thrive under good moisture conditions instead of less productive, drought-resistant varieties
    e. Improve the quality of the crop with irrigation
        1. Examples:
            a. Fruit is generally larger and more uniform in size
            b. Nuts fill out better
            c. Apples smoother
    f. Irrigation improves yields and quality when used for frost protection and crop cooling

D. Effect of land capability limitations (refer to page 11 in Planning For An Irrigation System).
    1. Are your field and soil conditions such that you can operate an irrigation system satisfactorily?
        a. Land topography and obstructions
        b. Drainage-requirements
        c. Soil characteristics
    2. Land topography and obstructions.
        a. Land topography is determined by
            1. Slope
                a. Steepness of the land

b. Generally, you can irrigate any slope that can be successfully cultivated if your system is designed properly and if proper soil conservation practices are used

c. If soil absorbs water readily, water may be applied to steeper slopes with less chance of runoff

d. Pastures and sod crops on steep slopes can also be readily irrigated with little chance of runoff

2. Rough ground

   a. Irregular slopes can be smoothed by land grading
   b. Land grading fills in the low places and removes the high spots
   c. Provides for even water distribution while irrigating and for uniform and positive flow of surplus water
   d. If land will need grading, the cost should be included in the estimate for installing an irrigation system

3. Obstructions

   a. Roads, buildings, power lines, and streams
   b. Must be considered in irrigation planning

3. Drainage Requirements (refer to page 12 in Planning For An Irrigation System).

   a. Drainage must be considered along with irrigation for water control in the root zone of the plants - thus a "complete water management program"
   b. Drainage problems

      1. Water will stand in low spots for several days after raining
      2. Too much water in the root zone is just as harmful as not enough water - shallow root systems become water-logged
      3. Too much water in root zone results in lack of air and thus limits the capacity of plant for taking up water and fertilizer
      4. Soils do not warm up as easily in the spring when they are wet instead of drained

   c. Drainage solutions

      1. Surface drainage

         a. Land grading and/or digging open shallow ditches

        b. Laid out on a gradual slope so they will empty into an outlet ditch at a lower level

    2. Subsurface drainage

        a. Water is drained through ditches or pipelines which are placed underground
        b. Pipelines drain water from a field and discharge it into outlet ditches

4. Soil Characteristics (refer to page 14 in Planning For An Irrigation System).

    a. Important to the irrigation system

        1. Water-intake rate
        2. Water-holding capacity
        3. Fertility of the soil

    b. Water-intake rate

        1. How fast the soil can absorb water
        2. Factors affecting intake rate

            a. Texture (size of the particles)
            b. Surface sealing due to compaction and salts

    c. Water-holding capacity

        1. The amount of water it will hold after it has drained by gravity
        2. Depends largely on soil texture

    d. Fertility of the soil

        1. Poor soil fertility is a result of severe erosion and of leaching of plant nutrients of the soil
        2. Most of root development takes place in the topsoil

E. Effect of fringe benefits from irrigation (refer to page 17 in Planning For An Irrigation System).

    1. Crop protection from frost and freezing weather.

    2. Crop cooling.

    3. Distribution of water-soluble fertilizers.

    4. Distribution of liquified animal waste.

    5. Distribution of pesticides.

    6. Control of harvest dates.

II. How much water will be needed? (Refer to page 21 in Planning For An Irrigation System.)

  A. Factor consideration.

    1. Compare the amount of water your crop will need with the amount available.

      a. How much total water will your crop use during the season

      b. How much water will you use daily when your crops need water the most

    2. If you run out of water during the growing season, you can still have a crop loss, even with an irrigation system.

  B. Effect of the seasonal water demand.

    1. Different crops require different amounts of water.

    2. The amount of water a crop uses during a season is called "seasonal consumptive use" or "seasonal water demand."

  C. Effect of the peak-use rate of water demand.

    1. Crops will usually use more water during their fastest growing period than during any other time.

    2. The amount of water used per day by the crop during this period is called "peak-use demand rate" or "peak-use rate of water demand."

    3. Must be concerned with how much water is available continuously, than with the total quantity needed for the season.

    4. The irrigation system must be capable of supplying enough water to meet the peak-use demand rate of the crop even if there is no rain during that period.

    5. The peak-use demand rate varies with climactic conditions, soils and crops.

    6. Refer to pages 22-23 in Planning For An Irrigation System for charts and peak-use demand rate calculations.

III. Satisfactory Sources of Water (quantity and quality). (Refer to page 24 in Planning For An Irrigation System.)

  A. Points to Consider.

    1. Look for a source of water that can be depended upon to furnish the amount of water needed.

2. Determine the legal right to use it.
3. Consider the distance the water is from the field.
4. Consider the height in which the water must be pumped.

B. Sources of water:

1. Streams.
2. Lakes, ponds or reservoirs.
3. Community pipelines and canals.
4. Wells.
5. City water (usually too expensive).
6. Possibly a combination of the above.

C. Effect of water rights laws.

1. Laws have been established in some states which control the use of water.
2. These laws apply mostly to water flowing in streams, but, in some states the laws may apply to wells and lakes as well.

D. Effect of the distance to the water.

1. The distance from the source of water to the field is an important factor in deciding if the source is satisfactory.
2. If a choice is a possibility in selecting a water source, get an estimate made of the total cost of pumping water from each source before making a decision.

E. Effect of the height water is to be pumped.

1. The decision in selecting a source of water may depend on the height from the water level to the field.
2. If pumping from a surface source such as a stream or pond, be concerned with the:
   a. Height from the water to the pump
   b. Height from the pump to the field
3. Considering the design of pumps, the height from the water to the pump should not exceed 15 feet for maximum efficiency.
4. There is no reasonable limit to the height from the pump to the field.

IV. Selecting a water application method most appropriate to topography, soil and crop. (Refer to page 43 in Planning For An Irrigation System.)

A. The three basic methods in which water can be applied:

1. From above the ground surface - sprinkler.

2. On the ground surface.

3. Under the ground surface.

B. Sprinkler method.

1. Water is sprayed into the air and it falls like rain to the ground.

2. Accomplished by using either one or more rotating sprinklers or perforated pipe.

C. Surface method.

1. Water is applied on the ground at the ground level.

2. It flows by gravity over the surface of the field.

a. By flooding the entire field as in close-growing crops
b. By directing water down furrows between rows as in row or bed crops
c. Trickle irrigation - water is applied very slowly onto the surface of the soil through tiny holes or valves in plastic pipe

D. Subsurface method.

1. Ground-water table must either be near the surface but below the root zone, or;

2. There must be an impervious layer of soil or rock below the root zone to hold the water.

3. Check dams and gates are used to maintain the water level in the soil from open ditches or from jointed or perforated pipe.

4. The water moves into the root zone by capillary action.

E. Effect of land slope in application selection.

1. The slope of land may determine which method of irrigation used.

2. Level land.

   a. Either naturally level or made level without too much expense
   b. Any of the previously mentioned methods may be used

3. Sloping land.

   a. May be limited to the sprinkler method
   b. An even distribution of water can be applied to almost any slope you can cultivate
   c. Must make sure water is applied slowly to prevent erosion

F. Effect of water intake rate.

1. Water intake rate of soil affects the method of irrigation to be used.

2. Coarse soils take water in faster than fine soils.

3. Most soils will take water faster during the first 20-30 minutes of irrigation than later.

   a. Air space is filled with water
   b. Water seals off soil surface by washing fine particles into spaces between larger particles

4. Soil with low water intake rate (0.5 inch per hour or less).

   a. Sprinkler method
   b. Surface method

5. Soil with high water intake rate (3.0 inches or more).

   a. Sprinkler method
   b. Subsurface method

6. Soil with moderate water intake rate (0.5-3.0 inches per hour).

   a. Sprinkler method
   b. Surface method
   c. Subsurface method

G. Effect of water tolerance of crops.

1. Crops that may develop fungi or disease under high moisture conditions.

   a. String beans are an example
   b. Sprinkler method may be difficult
   c. Moisture around the leaves from sprinkler irrigation tends to promote disease

2. Crops that cannot tolerate roots standing under water for several hours.
    a. Potatoes are an example
    b. Surface method would not be a practical method to use
    c. Some types of surface systems and soil conditions, the water must remain on the field for several hours before it can penetrate into the root zone

3. Weed control.
    a. Using flood water for weed control on various crops such as some grasses
    b. Surface method is to be used

4. Reducing weed growth.
    a. Subsurface method supplies very little moisture to the surface of the ground
    b. Helps to reduce weed growth
    c. May slow down germination of shallow planted seed

V. Determining irrigation cost and return on investment (refer to page 91 in Planning For An Irrigation System).

A. Compiling information needed.

1. Select the crop(s) to be irrigated.

2. Estimate the expected increase in yield from irrigation.

3. Determine the value of your crops per unit from current market prices.
    a. Pounds
    b. Bushels
    c. Ton

4. Determine the maximum water intake rate of your soil.

5. Find the seasonal consumptive use for your crop.

6. Find the peak-use demand rate for your crop.

7. Decide on the number of hours you wish to operate your system per day.

8. Determine the minimum number of days required for each irrigation.

9. Estimate the number of irrigations expected per season.

10. Determine the number of hours system will be operated per year.

11. Provide a sketch of the shape and dimensions of the field to be irrigated.

12. Determine the number of acres in the field.

13. Select a system.

14. Determine the number of acres the system will irrigate in the field.

15. Find the pumping rate in gallons per minute.

16. Select a source of water.

17. Determine the total lift (height) water is to be lifted.

18. Determine the operating head required by the system.

19. Determine the size of power unit needed (brake horsepower).

20. Select the type of power unit (gasoline, diesel, gas or electric).

21. Determine current interest rate.

22. Determine the stand-by charges for electricity.

23. Determine the amount of labor per acre per irrigation.

B. Determining the initial cost.

1. Initial cost information.

   a. Helps you decide whether to pay cash for the system or if you can afford to finance it
   b. Determine the annual depreciation cost, which is a part of the total cost of owning and operating a system

C. Determining the annual depreciation cost.

1. Annual depreciation cost is determined from:

   a. Initial cost of the system
   b. Interest
   c. Taxes and insurance
   d. Fixed charges
   e. Loss of income from land taken out of production for water development
   f. Life expectancy of the system

D. Determining the annual operating cost.

1. Annual operating cost is determined from your annual expenses in the operating system.

  - a. Fuel
  - b. Oil
  - c. Repair and maintenance of equipment
  - d. Reservoir and field maintenance
  - e. Additional seed, fertilizer, pesticides, and harvesting cost for the increase in yield
  - f. Labor

2. To find the annual operating cost:
   - a. Find the total annual cost of fuel
   - b. Find the total annual cost of oil
   - c. Find the total cost of gear oil
   - d. Find the total annual cost of maintenance of the power unit
   - e. Find the total annual cost of repair and maintenance of the irrigation equipment
   - f. Find the total annual cost of reservoir and field maintenance
   - g. Assume a total annual cost for the additional yield from irrigation
   - h. Find the total annual cost of labor
   - i. Find the total annual operating cost

E. Determining the return on investment.

1. Purpose for estimating the total annual cost of an irrigation system.
   - a. To have a figure with which to compare the value of the expected increase in production

2. To find the return on investment:
   - a. Determine the value of the expected increase from irrigation per acre
   - b. Find the total annual cost per acre for irrigating
   - c. Find the expected increase in profit per acre from irrigating with system

Home Irrigation Systems

Instructor's Guide:

1. This unit is provided as an option unit to the field irrigation unit for those programs with a major emphasis on Ornamental Horticulture.
2. The unit was prepared by Chuck Miller of Hermiston High School.

Objectives:

1. To develop a plot plan identifying the sizes and objectives that will affect the sprinkler system design.
2. To select the most appropriate sprinkler head for a given area.
3. To use manufacturer's information to determine spacing, GPM, radius and PSI required.
4. To balance the size of the individual circuits.
5. To determine the size of pipe to use throughout the system.
6. To identify the advantages of using electric controls in the sprinkler system.
7. To identify major problems of a sprinkler system.
8. To develop a winterization plan for the system.
9. To develop a bill of materials for the system as designed.
10. To install sprinkler system and have it operate appropriately.

Teaching Aids:

1. Project to be sprinkler irrigated.
2. Parts to construct irrigation system.
3. Trencher.
4. Graph paper.
5. Scales and compasses.

Student Activities:

1. Select a piece of property for the class to use as a design problem. Work in pairs and develop a plot plan.

2. Students will use previously prepared plot plan and locate heads and spray patterns and output (GPM).

3. Students will determine the size of the pipe and valves to use in the system. They will also determine the size of the circuits and where the manifold will be.

4. Students will identify the types of fittings necessary to complete the sprinkler system.

5. Students will develop a bill of materials for all parts needed to complete sprinkler system.

6. Students will construct a home sprinkler system based upon information learned in class.

References:

1. Toro Sprinkler Systems - Install It Yourself in 4 Easy Steps.

2. The ABC's of Lawn Sprinkler Systems - by A.C. Sarsfield.

3. Toro Irrigation Equipment Catalogue.

4. Rain Bird Irrigation Equipment Catalogue.

5. Buckner Irrigation Equipment Catalogue.

6. Toro Automatic Sprinkler System Owners Manual.

Introduction Ideas:

1. Utilize the "appearance" idea of a nice yard during the summer months by use of a Home Irrigation System.

2. Invite a guest speaker from a local business dealing with irrigation products to speak on Home Irrigation Systems.

Appendices:

1. Appendix A: Determining Gallons Per Minute

Home Sprinkler System

I. Basic System Design

A. What is a plot plan?

1. A scale drawing of the area to be watered, including all of the measurements.

2. Must include:

   a. Buildings
   b. Waterlines
   c. Sewer lines
   d. Septic tanks
   e. Electrical lines (burial)
   f. Fences
   g. Walks
   h. Drives
   i. Any object that will need to be watered around or that would affect the coverage

3. Use graph paper to lay out plan.

B. Why measure when preparing the plot plan?

1. The accuracy of the measurements will affect the plan of the system.

2. The accuracy of the measurements are directly related to the cost and effectiveness of the system.

C. What property details will affect the system design?

1. Width and contour of flower beds.

2. Heights of plantings.

3. Location and size of trees, light poles and other obstructions.

4. Areas that require protection from spray.

5. Steep banks and retaining walls.

6. Low windows, doors requiring protection from spray.

7. Direction of prevailing wind.

8. Height and kind of fencing.

9. Best location for controller.

D. What will need to be known about the water supply?

1. Location of water meter.
2. Size of meter and water service line to meter from main.
3. Location of city water main to determine length of service line.
4. Size and material of house service line.
5. Static (no flow) water pressure.
6. Location of well, lake. pond or source of water.
7. Capacity of water supply.
8. Size and capacity of existing pump.
9. Available power if new pump is to be installed.

II. General Design Rules

A. What are the three main rules to be considered for a productive sprinkler system?

1. The area to be watered will be completely watered.
2. The area will be watered uniformly.
3. The area will be watered in accordance with the wishes of the owner.

B. What areas may need special design consideration?

1. Street fronts.
2. Fences.
3. Building walls.
4. Walks, drives, patios.
5. Parking strips.
6. Narrow beds.
7. Trees.
8. Planting pockets.
9. Steep slopes.

C. How can the above problem areas be treated?

1. By using part circle heads.

2. By using shrub bubblers.

3. By using low gallonage heads.

4. By varying the length of irrigation.

5. By using a triangular spacing system.

D. How should sprinklers be spaced?

1. Designed and spaced for complete coverage.

2. Establishing a specific spacing pattern.

    a. Triangular (.87 x spacing)
    b. Square (.60 x diameter)
    c. Line
    d. Adjust patterns for wind drift or to fit a specific area.
    e. Supplement pattern to fill in small odd-shaped areas.

E. The common types of sprinkler heads available:

1. Impact drive rotary pop-up.

2. Gear driven rotary pop-up.

3. Above ground rotary impact drive.

4. Stationary lawn heads.

5. Pop-up spray head.

6. Bed heads (bubbler, steam, spray).

F. Determining GPM, PSI required and radius for selective heads.

1. Obtain the Manufacturer's Catalog.

2. Locate selected head.

    a. Example:

        1. Toro: 570 series, low gallonage, 180°
        2. Spec. #570P-12'-H, PSI=20, GPM-.9, radius 10', traingular spacing 60% of diameter

III. Balancing System and Determining Pipe and Valve Size.

A. How can you determine how many gallons per minute (GPM) are available to the sprinkler system? (Refer to Appendix A).

1. Given 3/4" water meter, 1" service line, 50 psi.

2. Use chart to determine GPM.

3. The answer is 15.0 GPM.

B. Balancing.

1. Using the system plan developed.

   a. Group sprinklers by type into sections
   b. Do not exceed the available water source

2. Balance the system so all sections require the same amount of water.

C. Determining Pipe Size.

1. Supply line.

   a. Must be as large as the largest valve used in the system
   b. If the distance is more than 100', increase pipe size by one size
   c.

Valve or pipe size	Max. GPM
1/2"	8
3/4"	14
1"	25

   d. The above system (Section III-A-3) requires 15 GPM, which will need 1" pipe and valves
   e. The pipe may be reduced in the circuit if the remaining part of the circuit doesn't require as many GPM

D. Where should valves be located?

1. In an area conveniently located to power and the water supply.

2. When grouping valves together, they form a manifold.

   a. Manifold should be located where one can conveniently operate the system manually

IV. Controlling the System

A. Why use an automatic system?

1. Saves time.

2. Saves money.

3. Saves water.

4. Allows the system to operate at any time.

5. Allows the system to operate for varying lengths of time.

B. When is the best time to water?

1. Early morning.

2. Before sun becomes too hot.

C. What are the two (2) major parts of an automatic system?

1. Automatic valves.

2. Time clock.

D. How should an operating schedule be established?

1. Basically a trial and error process.

2. Things to look for:

a. Run-off
b. Soggy areas
c. Dry areas

3. Once correct schedule is established:

a. Will not need to be changed unless there is a change in weather conditions

V. Maintenance and Winterization of the Sprinkler System.

A. Visual checklist of the system;

1. Plugged nozzles.

2. Rotary sprinklers that don't rotate.

3. Blockage of spray from the head.

4. Blockage of line-poor system output.

B. Visual checklist for maintaining valves:

1. Leaks around the top of manual valves (tighten packing).

2. Leakage through the valve - something lodged between the seat and disc.

3. Leakage caused by valve disc wear.

4. Valves that do not operate:
    a. Check control wire
    b. Check timer
    c. Make sure manual valve is open

C. How should the sprinkler system be protected from freezing?

1. Drain valves at low points in the system.

2. Use air pressure to blow water out of system and manifold.

VI. Construction of the System

A. Identify the types of fittings necessary to complete the sprinkler system.

B. Develop a bill of materials for all parts needed to complete your sprinkler system.

C. Secure all materials for the sprinkler system.

1. Ask for bids.

2. Purchase parts.

3. Pick up or have parts delivered.

D. Trench for the pipe lines.

E. Lay out parts.

F. Assemble system and test before covering trenches.

G. If coverage is adequate cover trenches and prepare to landscape.

H. Check for evenness of application of water and develop the irrigation schedule.

APPENDIX A

Chart #1: DETERMINING GALLONS PER MINUTE

Size Of:		Static Water Pressure (PSI)										
		Gallons Per Minute (GPM)										
Water Meter	Service Line	30	35	40	45	50	55	60	65	70	75	80
5/8"	1/2"	2.0	3.5	5.0	6.0	6.5	7.0	7.5	8.0	9.0	---	---
5/8"	3/4"	3.5	5.0	7.0	8.5	9.5	10.0	11.0	11.5	13.0	---	---
3/4"	3/4"	6.0	7.5	9.0	10.0	12.0	13.0	14.0	15.0	16.0	17.5	18.5
3/4"	1"	7.5	10.0	11.5	13.5	15.0	16.0	17.5	18.5	20.0	21.0	22.0
3/4"	1 1/4"	10.0	12.0	13.0	15.0	17.0	18.0	19.0	21.0	23.0	24.5	26.0
1"	3/4"	6.0	7.5	9.0	10.0	12.0	13.0	14.0	15.0	16.0	17.5	18.5
1"	1"	10.0	12.0	13.5	17.0	19.5	22.0	23.5	25.0	26.0	28.0	29.0
1"	1 1/4"	12.0	15.5	17.5	21.0	23.5	26.0	28.5	30.5	32.5	34.0	35.0

Production Records

Instructor's Guide:

1. A terminology page is included for reference.
2. The formulas for calculating 205 and 365 day adjusted weights for beef cattle are included.
3. A recommended format for written farm plans for crop production is included.
4. Simplified forms for record keeping are included. These records are simple but contain the essential factors for record keeping.
5. As students develop their projects and advance in their management practices, they may want to consider additional computer information from various sources. i.e., DIHA for Dairy production and breed association.

Objectives:

Upon completion of this unit, the students will be able to:

1. Understand the terminology used in Production Record Keeping.
2. Understand the importance as to why keeping records is important.
3. Calculate 205 and 365 day adjusted weights for beef cattle.
4. Plan out a written farm format for crop production.
5. Maintain the appropriate production records for their own project(s).

Teaching Aids:

1. The production records included in this unit.
2. Computer printouts obtained from various production areas.
3. OSU computer cow game.

Student Activities:

1. Involve the students in a discussion on how much records can tell them about their production projects. For example: Are they making or losing money? Are all of their animals producing to their maximum? Can some costs be cut to help make money or would investing a little more money increase their income?

2. Students maintain their records on their individual projects.

3. Visit a local livestock producer and have them explain the importance of record keeping.

References:

1. DIHA.

2. Appropriate breed associations.

Introduction Ideas:

1. Propose to the students the question of why keep records, what is so important about them, and why make decisions.

2. Provide a sample of poorly kept records and a sample of well kept records and let the students analyze for themselves the importance of record keeping.

3. Guest speaker with record samples to illustrate to the students the importance of records.

4. Impress upon students efficiency factors to increase production.

Table of Appendices:

1. Appendix A: Sheep Production Records.

2. Appendix B: Swine Production Records.

3. Appendix C: Beef Cattle Production Records.

4. Appendix D: Simmental Production Records.

5. Appendix E: Dairy Cattle Production Records.

6. Appendix F: Crop Production Summary.

Terminology

1. Dam: the mother.
2. Sire: the father.
3. Progeny: the offspring.
4. Pedigree: a list of ancestors.
5. Chain number
   Lot number
   Ear tag number : All are forms of individual animal identification.
   Brand
   Tatoo number
6. Registration number: the number given to the individual animal upon registration with the appropriate breed association.
7. Lambed: to have given birth to young lambs.
8. Calved: to have given birth to young calves.
9. Farrowed: to have given birth to young piglets.
10. Weaning: to withhold mother's milk from the young and substitute other nourishment.
11. Weaning weight: weight of young at time of weaning.
12. Yearling: an animal one year of age.
13. Rearing: how the animal was raised - as a twin or as a single.
14. Butter fat: the oily content of milk from which butter is made.
15. Adjusted weight: the actual weight divided by the actual days times 90 days. Adjusted weights allow all animals to be compared on an even basis.
16. To cull or culling: to eliminate from the herd or flock.

I. The Importance of Maintaining Records.

A. Production Records help to make the decision making process an easier task.

B. Production Records can be used as a method of culling animals, thus improving production efficiency.

C. Production Records can determine if herd or flock is at maximum production.

D. Production Records help to keep all important information on paper that otherwise may be forgotten.

E. Steps in Production Records:

1. Gather data.

2. Storing data.

3. Analyzing current data.

4. Comparing information.

   a. Gathering data and storing data are the more difficult steps to accomplish
   b. Analyzing current data and comparing data can be accomplished by hand or by computer.

II. Formula for 205 Day Adjusted Weights for Beef Cattle.

A. $\frac{\text{Actual Weight - Birth Weight}}{\text{Age in Days}} \times 205 + \text{Birth Weight} = \text{Unadjusted 205 Day Weight(lb)}$

B. Unadjusted 205 Day Weight + Age of Dam Adjustment = 205 Day Adjusted Weight (lb)

1. Subtract actual birth weight from actual weight at weaning (use standard of 90 lb for females and 98 lb for males if actual birth weight is unavailable).

2. Divide by age in days at weaning to obtain average daily gain (or age in days at time weight was taken).

3. Multiply average daily gain by 205.

4. Add the actual birth weight that was subtracted initially (or the standard of 90 lb for females and 98 lb for males if actual birth weight is unavailable).

5. Adjust for age of dam by using the following additive factors:

	Females	Males
2 yrs. old & younger, add to calculated 205 day wt.	40 lb	50 lb
3 yrs. old, add to calculated 205 day wt.	17 lb	14 lb
4 yrs. old and older	no adjustment	

III. Formula for 365 Day Adjusted Weights for Beef Cattle.

A. $$\frac{\text{Actual Final Weight - Actual Weaning Weight}}{\text{Number of Days Between Weights}} = \text{Average Daily Gain}$$

B. Ave. Daily Gain x 160 + Weaning Wt. (205 days) = 365 Day Adjusted Weight
Adjusted Age of Dam

1. Subtract actual weaning weight from actual final weight.

2. Divide by the number of days between weights to obtain average daily gain.

3. Multiply average daily gain by 160.

4. Add the weaning weight (205 day adjusted for age of dam).

IV. Recommended Format for Written Farm Plans.

A. General description of the area.

1. Average annual amount and distribution of rainfall.

2. Average number of days in the growing season.

3. Dates of first and last killing frosts.

4. Other relevant information on climate, general cropping programs, etc., common in the area.

B. Description of farm.

1. A map showing arrangement of fields.

2. Size of each field in acres.

3. Soil characteristics of each field.

4. Type of irrigation, if available.

5. Major annual weed problems expected in each field.

6. Perennial weed infestations in each field.

C. Description of weed control practices.

1. For each field, write a chronological account of the planting dates, harvest dates and any practices which

have a direct bearing on the control of weeds. Routine fertilizer and irrigation operations need not be included unless they directly influence the weed control practice.

D. Discussion.

1. Write a five year plan discussion including rationale behind decisions on choice of herbicide, cultural vs. chemical decisions, crop rotations, etc.

Appendix A

SHEEP PRODUCTION RECORD

Breed ____________________

Date Born ________________

Purebred Breeder ______ Commercial______

Ewe Name ____________________
Reg. No.

Reg. No.

Reg. No.

Reg. No.

Reg. No.

Reg. No.

Reg. No.

Lambing Record

Sire	Dam	Dam's Age	Lamb No.	Date Born	Sex M F W	Type Rearing [1]	Age in Days [2]	Market Weight	lbs of lamb weaned per ewe	Remarks [3]

[1] Type or rearing: TT=Born a twin, raised as a twin
T=Born a twin, raised as a single
S=Born a single, raised as a single
SS=Born a single, raised as a twin

[2] Age in days from date of birth to date weight was obtained.

[3] Ewes milking ability
ease of lambing
mothering ability

Appendix B

SWINE PRODUCTION RECORDS

Breed ____________________

Date Born ________________

Sow Name ____________________
Reg. No.

Reg. No.

Reg. No.

Reg. No.

Reg. No.

Reg. No.

Reg. No.

Farrowing Record				Litter Information								
Sire	Dam	Dam's Age	Date Bred	Date Born	No. pigs per litter	No. pigs died	No. pigs raised	Avg. weaning weight	lbs of hog weaned per sow	Age in Days [1]	Avg. Market Weight	Remarks [2]

[1] Age in days from date of birth to date weight was obtained.

[2] Farrowing problems

Appendix C

BEEF CATTLE PRODUCTION RECORDS

Breed ____________________

Date Born ________________

Purebred breeder ____ Commercial ____

Cow name ____________________
Reg. No.

Reg. No.

Reg. No.

Reg. No.

Reg. No.

Reg. No.

Reg. No.

Calving Record

Sire	Dam	Dam's Age	Horned or Polled	Calf No.	Calf Reg. No.	Birth Date	Sex M F S	Actual Birth Weight	Adj. Birth Wt.	Actual Weaning Weight	205 Day Adj. Weight	Actual Yrlg. Weight	365 Day Adj. Weight	Remarks [1]

---

[1] Ease of calving, milking ability, mothering ability

BEST COPY AVAILABLE

Cow Lifetime Production

COW'S TATTOO BRAND	01207
LOC.	LE
BREEDS IN COW	50SM 50AN
COW'S REGISTRATION NO.	14001
DATE PRINTING	10/17/83
PREVIOUSLY REGISTERED TO	660 C K R CATTLE CO
BREEDER	10786 ANDREW NILLES

PRESENTLY REGISTERED TO 2030
FAXON SIMMENTALS
JAY OR DARLEEN FAXON
RT 2 BOX 202 B
PHILOMATH OR 97370

Estimated Breeding Values	GROWTH			MATERNAL	
	Calving Ease	Weaning	Yearling	Calving Ease	Weaning
	96.0	102.4	98.2	98.5	99.3

	CALVING											WEANING				YEARLING				Dam's Summary Information		Remarks
	Tattoo/ Brand	Registration Number	Horned/Polled Status	Sire's Registration Number	Birth Date Mo. Day Yr.	Sex	Percent Simmental	Calving Ease	Actual Birth Weight Adjusted Birth Weight (lbs.)	Adjusted Birth Weight Ratio	Adjusted Birth Weight Rank/ Contemporaries	Actual Weaning Weight (lbs.) Age in Days at Weighing	205 Day Adjusted Weight	Weaning Weight Ratio	205 Day Rank/ Contemporaries	Actual Yearling Weight (lbs.) Age in Days at Weighing	365 Day Adjusted Weight	Yearling Weight Ratio	365 Day Rank/ Contemporaries	No. of Calves Avg. Calving Interval	Avg. Weaning Wt. Ratio MPPA	
COW	01207	014001	P	2 BISMARK	111270	H	50		80			590 267	518	116	4 42							
PROGENY	7135D	075862	P	11 FLORIAN	091372	H	75		77			330 180	419	83	21 23							
	698E	HERD K	H	5337 EIGER-50-	101673	B	75	1	102 92			397 156	563	104	18 42	755 316	921	101	9 15			
	686G	HERD 1		171430 CD SIR GALANT 40	101475	S	75		90 94			465 177	524	117	2 25							
	22H	HERD 2		39430 BRL KONRAD 5C	092676	S	75	1	95 95			469 192	494	117	3 25	770 373	760	111	3 27			
	972J	457973	H	247096 BAR S SIGNAL 503	101277	H	75	1	72 72	112	2 15	435 177	492	111	3 15							
	910K	565936	H	247096 BAR S SIGNAL 503	102678	B	75	1	95 95	81	18 18	535 189	572	114	3 18	1150 379	1090	119	2 13			
	925L	627574	H	247096 BAR S SIGNAL 503	100179	B	75	1	90 90	93	10 10	540 195	563	107	2 10	900 362	908	95	2 2			
	FS561P	860152	P	501286 PBM ELEVATOR	112982	H	75	1	85 85	100	2 2	500 168	591	99	2 2					8 533	107 105.8	

A

COW'S PEDIGREE

Relation	Registration No. Horned/Polled Status	Birth Date	Name	% Breeds
Sire's Sire	PMM1000		POLAR	PB SM
Dam	P 702	010167		100AN
Dam's Sire				
Dam's Grandsire				

388520
RC221-1

Appendix E

DAIRY CATTLE PRODUCTION RECORD

Breed ____________________

Date Born ________________

Cow name
Reg. No. ____________

Reg. No.

Reg. No.

Reg. No.

Reg. No.

Reg. No.

Reg. No.

Calving and Milking Record					Days					
Sire	Dam	Dam's Age	Calving Date	Sex of calf M F	Dry	Open	Milked	Pounds Milk	Mastitis problems	Remarks [1]

[1] Calving ease
days calf carried

Appendix F

CROP PRODUCTION SUMMARY

Crop______________________ Variety_______________________

Date Planted ____________________

Number of Acres	Estimated Expenses 1	Estimated cost/acre	Estimated yield/acre	Estimated Market Price	Estimated Net Profit	Remarks 2

---

[1] Liming cost, fertilizer cost, chemical/application cost, machinery use/rental cost

[2] Weed problems, bug problems, drainage problems

Projects, Initiation

Instructor's Guide:

1. Use project construction unit as a reward unit for motivated students who have projects to build.
2. Don't have a project unit as a substitute for a unit which needs to be taught in your local.
3. This project unit is an option to be used only if it is appropriate to your community's agricultural needs.
4. Project construction is broken into two separate teaching units. The purpose for this is: a) to keep the students inspired to work during shorter periods of time; b) to allow time to locate and secure any parts or materials needed in-between construction periods; c) to eliminate any frustration that a student may face when working too long on a particular project; d) to inspire better working attitudes during project construction, and e) to provide a variety of activity to the heavy in-class work during the FBM unit.
5. Maintain shop safety standards during project construction.
6. Keep all students busy or go to another unit.
7. Have students develop a complete cost of materials sheet and project plans sheet before they begin their projects (i.e. these should be done at home by students so shop time is not wasted on this activity).
8. Obtain project plans by writing for a "Shop Plans Book," at:

   a. Instructional Materials Lab.
   10 Industrial Ed. Building
   University of Missouri-Columbia
   Columbia, Missouri 65201

   b. Agricultural Mechanics Plans
   Vocational Education Productions
   California Polytechnic State University
   San Luis Obispo, California 93407
   1-800-235-4146 Cost - $3.50

   c. Agricultural Shop Projects
   Oklahoma State Department of Vocational and Technical Education and Curriculum and Instructional Materials Center
   1515 West Sixth Avenue
   Stillwater, Oklahoma 74074
   Teacher Edition - $15
   Student Edition - $10

d. Oregon State University
Herb Hansen - Ag Eng
Gilmore Hall 122
Corvallis, OR 97331
754-2041

e. Agriculture Education Department
5032 Haley Center
Auburn University
Auburn, Alabama 36849
(205) 826-4431

f. Montana State University
Department of Agriculture Education
Bozeman, Montana 59717
(406) 994-3201

Agricultural Agencies

Instructor's Guide:

1. This is an example of the type of thing that could be taught in a unit called Agricultural Agencies.
2. Please use this material as it is appropriate and supplement with material for your local situation.
3. Use only those Agricultural Agencies in unit as found in your immediate local area.

Objectives:

Upon completion of this unit, the student will be able to:

1. List local farm agencies and groups.
2. Explain local farm agencies and groups as to their purpose, membership, cost and functions.
3. Identify local farm agencies and groups as to promotional, educational or service.

Teaching Aid:

1. Handbook on Cooperative Basics: American Institute of Cooperatives
1800 Massachusetts Avenue N.W.
Washington, D.C. 20036

Student Activities:

1. Students list the Agricultural Agencies in the local area.
2. Student prepare short Agricultural Agency reports to present to the class.

References:

Farmers Home Administration
Oregon Wheat Growers League
Oregon Wheathearts
Agriculture Marketing Service
Oregon State Police
Occupational Safety & Health Administration
Grange
Breed Associations
Farm Bureau

References contd.

United States Department of Agriculture
Production Credit Association
Bureau of Land Management
Food & Drug Administration
Oregon Fish & Wildlife Department
Forest Service
Extension Service
Federal Land Bank Association
State of Oregon Forestry Department
Soil and Water Conservation District
Agriculture Stabilization and Conservation Service
Fire Department
Any other Agricultural Agencies in given local area

Introduction Ideas:

1. List local Agricultural Agencies in given area.

2. Define "terms" associated with Agricultural Agencies.

   Agency - A group having action, power and or means.

   Organization - Any unified group or body or persons formed for some specific purpose.

   Assessment - The amount of money owed, based on an estimated value of billings.

   Dues - The amount of money to be paid to a group by each member.

   Membership - Belonging to an organization or group.

Table of Appendices:

1. Appendix A: The Cooperative Farm Credit System

2. Appendix B: Production Credit Association

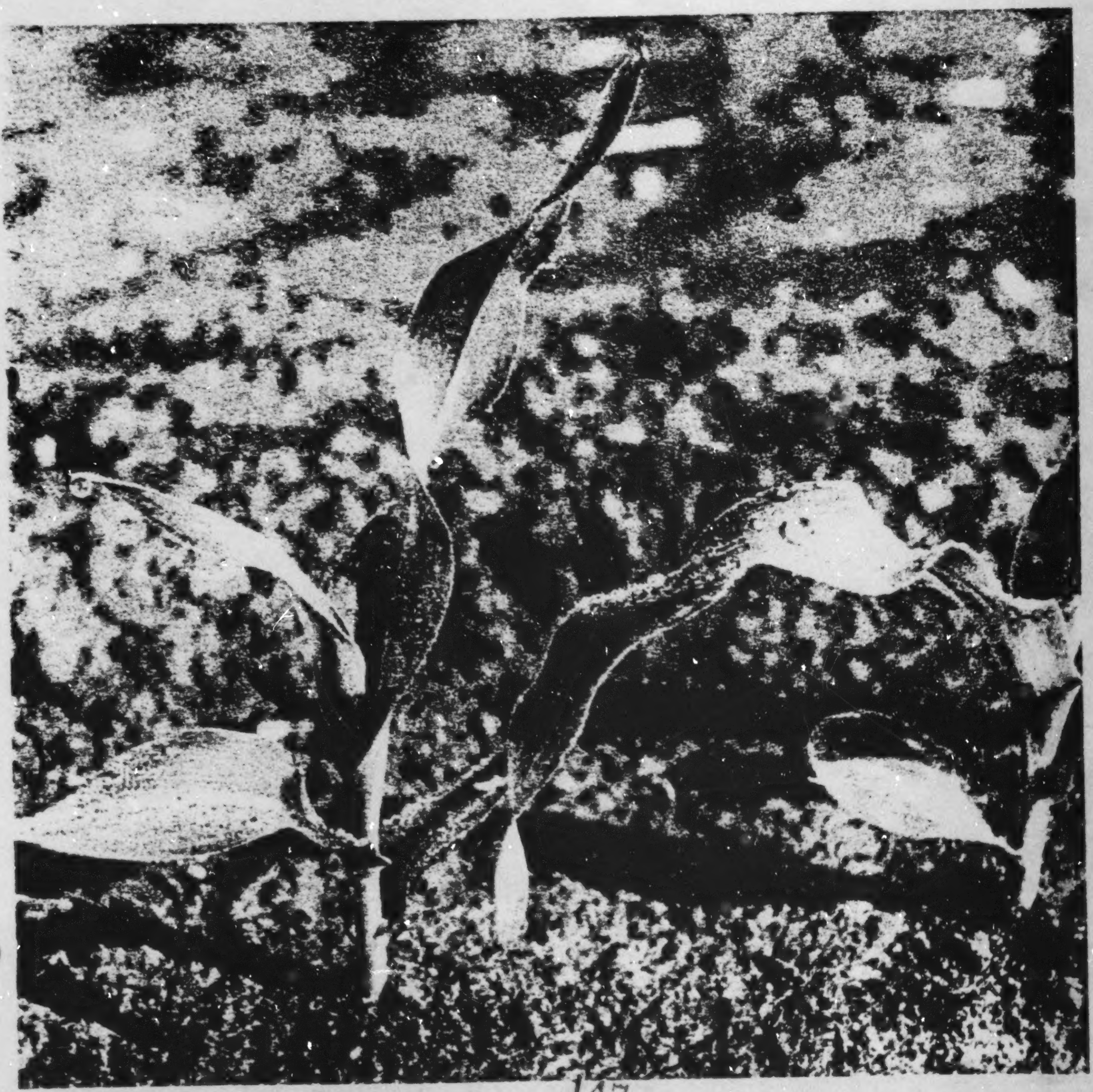
3. Appendix C: Oregon Wheat League

BEST COPY AVAILABLE

Appendix A

The Cooperative Farm Credit System

Its Functions,
Organization, and
Development



FARM CREDIT SERVICE

AN INTRODUCTION

The cooperative Farm Credit System is designed primarily to improve the income and well being of American farmers and ranchers by furnishing sound, adequate, and constructive credit and closely related services to them, their cooperatives, and to selected farm related businesses necessary for efficient farm operations.

The System also provides credit for rural homes, to producers and harvesters of aquatic products, and to associations of such producers.

This is accomplished through the three component parts of the System—Federal Land Banks and Federal Land Bank Associations, Federal Intermediate Credit Banks and Production Credit Associations, and the Banks for Cooperatives. Each plays a key role in filling the unique credit requirements of its borrowers.

LONG TERM CREDIT

The 12 Federal Land Banks may make loans of from 5 to 40 years secured by the equivalency of first liens on real estate through more than 500 local Federal Land Bank Associations.

Loans may be made to farmers and ranchers, to corporations engaged in the production of agricultural products, to businesses providing farmers with on-the-farm services, and to non-farm rural homeowners.

Farmers and ranchers may obtain loans for any agricultural purpose and for other requirements. Common purposes include the purchase of farms, farmland, equipment, and livestock; refinancing existing mortgages and paying other debts; constructing and repairing buildings; and financing other farm, farm home, or family needs. Since the Banks are primarily agricultural lenders, credit extended for other than agricultural purposes is dependent on the agricultural assets of the borrower.

Owners of farm related businesses may borrow to purchase or refinance necessary sites, capital structures, equipment, and for initial working capital.

Loans to rural residents may be made for the purposes of building, buying, remodeling, improving, refinancing, or repairing a rural home.

The Banks are authorized to make only sound loans. The amount of credit extended, based on the credit worthiness of the applicant, cannot exceed 85 percent of the collateral taken as security.

Under certain circumstances, the Land Banks may make simultaneous loans with the Farmers Home Administration of the U.S. Department of Agriculture.

SHORT AND INTERMEDIATE TERM CREDIT

The 12 Federal Intermediate Credit Banks provide loan funds to the more than 400 local Production Credit Associations and discount the notes of eligible borrowers given to other institutions financing agricultural producers. The FICBs may also participate with the Production Credit Associations in making loans.

Production Credit Associations make loans with terms up to 7 years to farmers and ranchers, producers and harvesters of aquatic products, rural homeowners, and farm related businesses. Loans may be made for a variety of purposes related to the production of agricultural products, the production and harvesting of aquatic products, the purchase, repair, or maintenance of rural homes, and other requirements of the borrower.

At no time, however, may the total credit extended for other purposes exceed the value of assets devoted to agricultural or aquatic endeavors, and the total amount of credit extended rural homeowners may not exceed 85 percent of the appraised value of the property.

Production Credit Associations may participate with one another in making loans and may also participate with other institutions in financing agricultural producers, including commercial banks.

CREDIT FOR COOPERATIVES

The 12 district Banks for Cooperatives make loans directly to eligible cooperatives. The Central Bank for Cooperatives participates with the district Banks in loans which exceed their individual lending limits. The Banks may also participate with one another and with other financing institutions in making loans.

Eligible cooperatives may include any association of farmers, ranchers, or producers or harvesters of aquatic products, or any federation of such associations which is operated on a cooperative basis. To be eligible, a cooperative must be engaged in one of the following functions.

1. Storing, packing, processing, or marketing farm or aquatic products.
2. Purchasing, testing, grading, processing, furnishing, or distributing farm or aquatic supplies.

LENDING POLICIES

3. Furnishing business services to farmers, producers or harvesters of aquatic products, or other eligible cooperatives.

The Banks make term loans for purposes such as constructing, remodeling, or expanding facilities, or for purchasing land, buildings, or equipment.

Seasonal loans are made to finance current or seasonal assets.

Both types of loans may be secured or unsecured, but loans scheduled for payment over an extended period of time are usually secured by adequate collateral. Seasonal loans may be secured by goods or merchandise which are in acceptable storage.

The Banks and Associations of the Farm Credit System are authorized to make only sound loans. To determine what constitutes a sound loan, one that will benefit both the borrower and the lender, the following factors are considered.

1. *The individual or entity*—A prerequisite for a sound loan is an applicant of established integrity. Responsible and cooperative management must be evident. The importance of this factor is so great that it can affect the weight placed upon the other credit factors. In analyzing the applicant, the Bank or Association evaluates character, experience, record, and prospects of management in finance and operation.

2. *Financial position and progress*—Financial responsibility reflects ability to meet obligations, continue business operations and protect the lender against undue risk. The applicant's total assets controlled and history of earnings to date are significant measures of financial responsibility.

3. *Repayment capacity*—The determination of repayment capacity requires an analysis of cash flow history and projection. A cash flow projection reflects cash generated from the applicant's operation and all other sources. Generally, the flow of cash shall be sufficient to meet all obligations and provide a remainder for contingencies.

4. *Basis of approval*—The amount of the loan, use of funds, and loan terms are the principal factors over which the lender has direct control. Therefore, the loan must be constructive in amount and purpose and practical as to repayment terms for both the borrower and the lender. Loan conditions such as loan agreements, personal liability, additional collateral, insurance, etc., are required as conditions warrant.

5. *Collateral offered or available as security*—Collateral needs are contingent upon the requirements of the law and as dictated by the strengths and weaknesses of all credit factors. The requirement of collateral and collateral taken must reasonably protect the lender, provide the necessary control of equity and repayment, and leave the borrower in a position to manage his business constructively.

APPLYING FOR A LOAN

FEDERAL LAND BANKS—An individual applies for a Federal Land Bank loan at the local Federal Land Bank Association serving the county in which the property is located.

When the application is filed at the Association, the applicant gives information regarding his financial status, the purpose for which the loan will be used, and other pertinent data.

A representative of the Association or Bank then appraises the property and checks the credit worthiness of the applicant.

When the loan application is approved and accepted by the applicant, the title to the property is examined and, if it is acceptable, the loan is closed.

PRODUCTION CREDIT ASSOCIATIONS—To apply for his first loan from a Production Credit Association, the prospective borrower contacts the Association serving the county in which his operation is located. He then discusses his plans with the PCA manager or field representative and fills out a formal application.

The borrower outlines his operation and, working with the PCA, determines how much money he will need and works out a repayment plan. In addition, he furnishes the PCA with a financial statement.

The PCA representative then looks over the applicant's operation and together they determine the best course of action.

Regular PCA borrowers may not have to go through these initial steps each time. Many borrowers have established lines of credit with their PCA and enjoy over-the-counter service. These borrowers arrange for their credit ahead of time and draw money as they need it.

BANKS FOR COOPERATIVES—In order to obtain a loan from a Bank for Cooperatives, the cooperative contacts the Bank serving the state in which it has its headquarters. The cooperative outlines its credit requirements for the Bank. The request is considered by Bank officers and, if approved, a loan agreement and other necessary legal papers are forwarded to the cooperative. The officers of the cooperative sign the papers and return them to the Bank. Loan funds are then advanced as needed under the terms of the loan agreement.

OBTAINING LOAN FUNDS

The Farm Credit Banks obtain most of their loan funds through the sale of securities to investors in the Nation's money markets. The Federal Land Banks, Federal Intermediate Credit Banks, and Banks for Cooperatives issue their own consolidated bonds through a fiscal agency jointly employed by all 37 Banks. The bonds are sold through a nationwide group of securities dealers.

Over the years, the bonds issued by the Banks have developed a reputation among investors second only to securities of the United States Government, though they are not insured or guaranteed by the Government in any way.

The Land Banks and PCAs also obtain some loan funds through the sale of Farm Credit Investment Bonds to their own borrowers. These bonds, designed for small investors, provide an opportunity for borrowers to invest in the Associations and receive a fair return on their money. Unlike the consolidated bonds, Farm Credit Investment Bonds are not available to the general public.

DEVELOPMENT AND OWNERSHIP

The present authority for the activities of the Banks and Associations of the cooperative Farm Credit System is contained in the Farm Credit Act of 1971. This Act supersedes all previous Acts and Resolutions governing the System. However, the various units of the System came into being at different times in history to fill different needs.

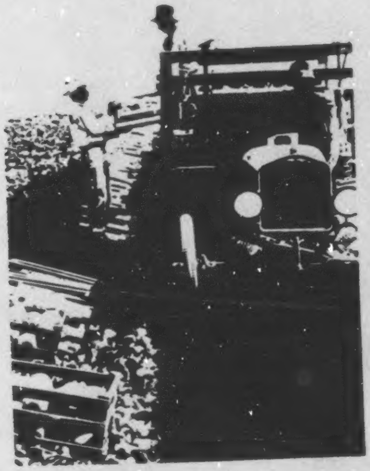
Federal Land Banks and Associations—Shortly after the turn of the century, agriculture began to move from a subsistence type endeavor of a man and his family to an industry where family farms provided for the increasing number of people in the cities. The industrial revolution was moving into agriculture. It called for larger farms, more fertilization, more intensive labor, and added mechanization. Land, once a gift from the Government to the tiller of the soil, was now bought and sold. The farm mortgage, which had first been a rare, then a casual, feature of farm life, was becoming an economic necessity. But available credit was geared to the needs of industry, not to agriculture. Most of it was short term and expensive. Industry had developed its own system of capital financing and credit. But no such system existed for agriculture. Money was needed by farmers and needed badly.

Congress recognized this need and, after considerable study, approved the Federal Farm Loan Act of 1916. The Act provided for the establishment of the Federal Land Banks and local Federal Land Bank Associations (then called National Farm Loan Associations) through which the Banks would make loans. Stock to capitalize the Banks was subscribed by the U.S. Treasury.

However, the law also provided a means by which the Land Bank stock would eventually be acquired by the Associations through stock subscriptions by borrowers in the Associations.

This was totally achieved in 1947 when the last of the Banks became owned by the Associations. The Associations, in turn, are owned by their borrowers.

Today, a borrower invests an amount in proportion to his loan in the stock of his local Association. The Association invests an equal amount of stock in the Land Bank. This helps capitalize the Banks and Associations and maintains ownership and control by borrowers. The stock is retired at its par value when loans are repaid.



The Land Banks, after providing for reserves as required by law and for net worth objectives necessary for sound business operations, may distribute any net earnings among the Associations in the form of dividends. The Associations, in turn, may pass dividends on to their stockholders. What is retained by the Associations is used for expenses and to establish appropriate reserves to meet their endorsement liability on loans and maintain satisfactory net worth positions. The Associations also defray expenses from loan service payments made to them by the Banks.

Federal Intermediate Credit Banks and Production Credit Associations—The decade of the 1920's marked a period of agricultural depression which grew worse as the years went on. In an effort to provide agriculture with more credit—particularly of a short and intermediate term nature—Congress passed the Agricultural Credits Act of 1923. The Act provided for the establishment and capitalization of 12 Federal Intermediate Credit Banks. It was intended these Banks discount the notes of agriculture producers given to other financing institutions, thus helping to fill the existing credit gap in which farmers found themselves. However, financial institutions did not use the services of the Credit Banks to the extent expected and the credit needs of farmers remained unfilled.

The situation continued to deteriorate through the 1920's and in the early 1930's the entire country was in a Great Depression.

In 1933, Congress acted again. It passed the Farm Credit Act of 1933 which authorized the establishment of local Production Credit Associations which could discount farmers' notes with the Credit Banks. It also provided for the initial capitalization and staffing of these institutions and brought credit service closer to borrowers.

The Federal Intermediate Credit Banks were entirely owned by the Government until 1957. At that time—as a result of passage of the Farm Credit Act of 1956—Production Credit Associations began to acquire stock in the Banks. The ultimate goal, as expressed in the Act, was the ownership of the Banks by the Associations.

THE FARM CREDIT ADMINISTRATION

The ownership of the Banks by the Associations was made possible by provisions in the law which allowed the Associations to make direct purchases of stock in the Banks and which allowed the Banks to return savings to the Associations in the form of stock. Complete ownership of the Banks by the Associations was achieved in 1968.

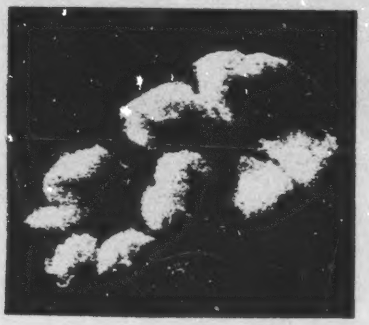
Meanwhile, members of Production Credit Associations had been acquiring stock in the Associations by purchasing it in proportion to the amount of their loans. The complete ownership of the Associations by their members also was achieved in 1968. Borrowers continue to provide the basic capital of the Associations by purchasing stock in proportion to their loans.

As credit cooperatives, PCAs may return savings to borrowers through the payment of dividends on stock and through patronage refunds.

Banks for Cooperatives—The Farm Credit Act of 1933 also recognized the need which farmers' marketing, supply, and business service cooperatives had for credit. It provided for the establishment and initial capitalization of the 13 Banks for Cooperatives.

The Farm Credit Act of 1955 paved the way for the ultimate ownership of the Banks by the cooperatives which borrow from them. The cooperatives acquire stock in the Banks by purchasing one or more qualifying shares as a condition to their first loan, by buying additional shares in proportion to interest paid on loans, and through Bank savings distributed in the form of stock.

Like the PCAs and FICBs, the Banks for Cooperatives became completely owned by their borrowers in 1968.



The Banks and Associations of the cooperative Farm Credit System operate under Federal law and are chartered by the Federal Government. They are supervised, according to the law and in the public interest, by the Farm Credit Administration, an independent agency in the Executive Branch of the Government.

The Farm Credit Administration was first established by an Executive Order of the President in 1933. At that time, all Farm Credit institutions were placed under its supervision. It remained an independent agency until 1939 when it was made part of the U.S. Department of Agriculture. It was returned to its independent status by the Farm Credit Act of 1953. That Act also provided for increased participation by borrowers in the control of the System by establishing a Federal Farm Credit Board as its top policy-making body and by paving the way for the ultimate ownership of the entire System by its borrowers.

MANAGEMENT AND CONTROL

Although the Farm Credit Administration is an official agency of the Government, its expenses are paid by the Banks and Associations of the System. Thus, not only does the System operate at no expense to the Government, but so does its supervisory agency.

The primary functions of the Farm Credit Administration are to assure the units of the System operate according to the law and the regulations governing their activities, to examine the institutions which comprise the System, and to coordinate some of the System's activities in the best interests of the borrowers.

For purposes of management of the cooperative Farm Credit System, the country is divided into 12 Farm Credit districts. At the same location in each district, there is a Federal Land Bank, a Federal Intermediate Credit Bank, and a Bank for Cooperatives. The Central Bank for Cooperatives is in Denver, Colorado. The district Land Banks and Credit Banks serve Associations in their respective territories.

Stockholders who share ownership of the Banks and Associations have a voice in the control of the Farm Credit System from the local to the national levels.

LOCAL BOARDS—Based on the democratic principle of one member—one vote, stockholders directly elect the boards of the local Federal Land Bank Associations and Production Credit Associations. The local boards hire the management of their Associations and set local policies. The boards of cooperatives which borrow from the Banks for Cooperatives are elected by the members of those cooperatives.

DISTRICT BOARDS—The boards of the Federal Land Bank Associations, Production Credit Associations, and cooperatives which hold stock in the Bank for Cooperatives in the respective Farm Credit districts jointly elect two members to the district Farm Credit board. A seventh director—the director-at-large—is appointed by the Governor of the Farm Credit Administration with the advice and consent of the Federal Farm Credit Board.

The district directors serve as the boards for all three Banks in their respective districts. As such, they hire management and set policies for the individual Banks. Operating as a district board, they set policies in areas of joint services by all three Banks and coordinate activities of the Banks in the best interests of the borrowers. This is done in accordance with the law and under regulations established by the Farm Credit Administration.

Appendix B

Production Credit Associations

How They Operate

Production Credit Association

Agriculture in the United States is constantly growing and changing. It is a dynamic industry, the largest in the Nation and perhaps the most essential.

To continue to make the American people the best fed at the lowest real cost of any people in the world, our producers of food and fiber use the latest developments in science and technology. To gain economies of scale, they have expanded their operations, utilizing more land together with larger and more expensive equipment and facilities.

All of this takes vast amounts of capital. The average capital investment required for each farm worker, for example, is more than twice that required for workers in manufacturing industries.

To keep pace, agricultural producers need ever-increasing amounts of capital. A large portion of this is borrowed capital —credit.

Those who harvest the sea also have a need for credit, as do rural residents and persons who provide farmers with the on-the-farm services they need for efficient operations.

Credit of this kind, however, is frequently highly specialized credit and must be tailored to fit the needs of individuals.

This booklet is about an important source of such credit, a source owned by the borrowers themselves. It is about the Nation's Production Credit Associations, how they operate, and why they are specialists in filling the unique credit requirements of their borrowers.

There are more than 400 Production Credit Associations throughout the United States serving borrowers through some 1,500 full time offices. They provide short and intermediate term credit and closely related services to farmers and ranchers, rural residents, selected farm related businesses, and producers or harvesters of aquatic products.

WHO BORROWS FROM PCAs

Production Credit Associations may make loans with terms of up to 7 years in length to any of the following.

1. *Farmers and ranchers.* A farmer or rancher is one who owns agricultural land or is engaged in the production of agricultural products, including aquatic products under controlled conditions.

The Associations may make loans to farmers and ranchers for any agricultural purpose or for other requirements. Because the Associations are primarily agricultural lenders, the amount of credit extended for non-agricultural purposes is affected by the borrower's agricultural assets.

2. *Legal entities engaged in the production of agricultural products.* A legal entity is any partnership, corporation, estate, trust or other entity which has a legal authority to conduct a business. Eligibility of a legal entity is dependent on the following.

a. The percentage of the value or number of shares of its outstanding voting stock owned by those conducting the farming or livestock operation.

b. The percentage of the value of its assets related to the production of agricultural products.

c. The percentage of its income originating from the production of agricultural products.

3. *Producers or harvesters of aquatic products.* A producer or harvester of aquatic products is someone engaged in the production or harvesting of aquatic products for economic gain in open waters under uncontrolled conditions.

Legal entities engaged in the production or harvesting of aquatic products are also subject to the same conditions as those engaged in farming or ranching operations.

4. *Rural residents.* A rural resident is one who either owns and occupies a home located in a rural area or who soon intends to. Such homes are defined as single family, moderate priced dwellings in open areas primarily devoted to agriculture and in towns and villages where the population does not exceed 2,500 persons. Mobile homes may also be considered as rural residences under certain conditions.

Loans may be made to buy, build, improve, repair, refinance, or remodel a rural home.

5. *Farm related businesses.* A farm related business is one which furnishes custom type services performed on the farm and directly related to farm operating needs.

Loans may be made to farm related businesses for working capital, equipment or operating needs. Such loans, however, are confined to financing those assets or business activities directly related to custom type services performed on the farm.

6. *Combined operations.* Where an applicant's operations include a combination of farming, producing or harvesting aquatic products, or a farm related business, eligibility can be determined on the basis of the criteria for either or any combination of these operations.

HOW TO APPLY FOR A PCA LOAN

To apply for his first loan a prospective borrower contacts the Production Credit Association serving the county in which his operation is located. He then discusses his plans with the PCA manager or field representative and fills out a formal loan application.

Working with the PCA, the prospective borrower outlines his operation, determines how much money he will need, and considers repayment methods. He also furnishes the PCA with a financial statement showing what he owns and what he owes, just as any other businessman would do.

A representative of the PCA looks over the prospect's business operation to obtain additional information helpful in assuring the repayment schedule is realistic. The prospect and the PCA representative then prepare a cash flow projection—an estimate of income and expenses—and work out the terms of the loan.

This entire process is beneficial because it gives the prospect an accurate picture of his operation. It also makes it possible for the PCA to provide the kind of credit and service needed.

After a borrower becomes more familiar with his Association and the Association knows his operation, some of these initial procedures may not be necessary. For the established PCA borrower, a loan is almost as near as his telephone. Most Associations have adopted procedures which permit over-the-counter service to borrowers whose records are satisfactory. The initial procedure, however, protects both the PCA and the borrower.

Recognizing that many borrowers have recurring credit needs at certain times of the year, many PCAs have instituted budget or line of credit financing plans. Under these plans, a borrower arranges in advance for a loan that will adequately cover all his financial requirements for an entire season or agricultural cycle. He draws the money as he needs it and repays it according to a pre-arranged schedule, perhaps when he sells his product.

There is no interest on any part of a loan until the money is actually drawn. When any part of the loan is repaid, no further interest is charged on the portion repaid. In short, a borrower pays interest on each dollar used only for the number of days he uses it. All interest charges and loan service fees, if any, are clearly explained to the borrower.

BORROWERS INVEST

Each borrower from a Production Credit Association invests in that Association to help capitalize it.

A farmer, rancher, or producer or harvester of aquatic products buys Class B (voting) stock in his Association in proportion to the amount of his loan. This is usually just added to the amount of the loan so he does not need to have the cash available.

Members frequently buy larger amounts of stock to help capitalize their Associations so they can better fill the growing credit needs of borrowers.

When their loans are repaid, members often retain their Class B stock and use it again when they obtain another loan. If a member doesn't borrow for two years, his stock is converted to Class A (non-voting) stock. By holding their stock as an investment, members strengthen the financial structure of their Associations. The conversion to non-voting stock, however, keeps the control of the Association in the hands of those who are active borrowers. Of course, a member who does not have a loan outstanding may list his stock with the Association for disposal.

Borrowers other than farmers, ranchers, or producers or harvesters of aquatic products also help capitalize the Association through the purchase of participation certificates as conditions to their loans. They buy these certificates in amounts proportionate to their loans. The participation certificates do not carry voting rights.

PCAs ARE CREDIT COOPERATIVES

Production Credit Associations are controlled by boards of directors elected by and from their voting members. Each member of the PCA has one vote regardless of the amount or number of shares of stock he owns. The Associations are, therefore, credit cooperatives owned and controlled by their members.

Because the boards of the Associations are composed of people who live in the area and who are active borrowers, they know what it takes to operate successfully in their particular localities.

Each board sets the overall policies for its Association as provided for in its bylaws and hires a manager to conduct the day-to-day business operations. He may carry the title of manager, secretary-treasurer, or president and may have several people on his staff depending on the size of the Association and its business volume. Many large Associations have branch offices for the convenience of their members.

The board must also see that the Association is operated in an efficient manner in accordance with established policies, regulations, and the law governing PCA operations and activities.

In addition to setting policies, hiring management, and being responsible for the operation of the Association, the board may also appoint various committees. Perhaps the most important of these is the loan committee. It usually is composed of two directors and the manager.

The function of the loan committee is to review loan applications and determine whether or not a loan is to be granted.

The board may delegate loan closing authority to the manager or other employees. However, even if this authority is delegated, the responsibility still rests with the board.

BORROWER OWNED AND BORROWER ORIENTED

Because they are actually owned by those who use them, Production Credit Associations have always been pacesetters in providing credit on terms suited to their borrowers.

For example, a farmer who needs production credit to buy seed and fertilizer may be unable to repay his loan until his crops are marketed. Meanwhile, he may have limited income and need additional funds each month for living expenses.

A dairy farmer, on the other hand, may want to arrange his loan payments to coincide with his monthly milk checks. A rancher or cattle feeder may require credit in yet another form.

But no matter what the particular credit requirements of the borrower are, the directors and manager of the local PCA are familiar with them.

The terms of a PCA loan may vary depending on the situation. A borrower may obtain any amount of credit he needs if, in the judgment of the loan committee, his record, financial condition, farm operation, and managerial skill indicate he can and will repay it.

CREDIT FACTORS

Production Credit Associations base credit decisions on five basic factors. These factors are considered pertinent to granting a sound loan.

1. *The individual or entity.* A prerequisite for a sound loan is an applicant of established integrity. Responsible management must be evident and must be willing to cooperate with the PCA. This factor is so important that it can affect the weight placed on all other credit factors. Analysis includes a careful evaluation of character, experience, record, and prospects of management in finance and operation.

2. *Financial position and progress.* Financial responsibility reflects the ability to meet obligations, continue business operations, and protect the PCA against undue risk. The applicant's total assets controlled, equity owned, contingent liabilities, and history of earnings are significant measures of financial responsibility.

3. *Repayment capacity.* The determination of repayment capacity requires an analysis of cash flow history and projection. A cash flow projection reflects cash generation from the applicant's operation and all other sources. Generally the cash flow should be sufficient to meet all obligations and provide a remainder for contingencies.

4. *Basis of approval.* Loans must be constructive in their amount and purpose and practical as to repayment terms for both the borrower and the PCA. Loan conditions such as loan agreements, personal liability, additional collateral, insurance, etc., are required as conditions warrant.

5. *Collateral.* Collateral needs are dictated by the strengths and weaknesses of other credit factors. The collateral taken shall reasonably protect the lender, provide the necessary control of equity and repayment, and leave the borrower in a position to constructively manage his business.

The prime purpose and reason for these five credit factors is to assure loans that will be beneficial to the borrower and sound business for the PCA.

OTHER SERVICES

In addition to providing credit and financial advice, many Production Credit Associations provide borrowers with other services.

Most Associations offer credit life insurance giving borrowers the peace of mind that comes with knowing their loans will be repaid if something were to happen to them.

In areas where hail damage is a hazard, some PCAs make it possible for their members to buy hail insurance, thus protecting both the borrower and the Association against loss.

By working with cooperatives and other dealers, many PCAs have made credit available at the point of sale enabling farmers to obtain needed supplies with time-saving convenience. This has also helped cooperatives by relieving them of the need to provide credit.

Many Associations are offering electronic farm recordkeeping services which provide members with accurate records and basic information helpful in making informed management plans and decisions.

These and other services show that Production Credit Associations are responsive to the needs of their members.

SAVINGS RETURNED TO BORROWERS

As credit cooperatives, Production Credit Associations share their savings with their borrowers. Savings are returned to borrowers through dividends on stock and also through patronage refunds in proportion to the interest paid on loans. Patronage refunds may be paid in cash, stock, or participation certificates.

What would be earnings in a profit motivated business become savings to borrowers from Production Credit Associations and have the effect of reducing interest paid on loans.

FEDERAL INTERMEDIATE CREDIT BANKS

In each of the 12 Farm Credit districts in the United States, there is a Federal Intermediate Credit Bank. These Banks are the chief source of loan funds for the Production Credit Associations and may participate with the Associations on some loans. Their primary function, however, is to provide loan funds to the PCAs and supervise some of their operations. They also discount notes of farmers given to certain other financing institutions serving agriculture.

The FICBs obtain their loan funds through the sale of securities to investors in the Nation's money markets. These securities are marketed through a fiscal agent in New York City with the assistance of a nationwide group of securities dealers.

The Banks make every effort to keep the cost of loan funds to PCAs as low as possible. These rates, however, depend to a large extent on the rates the Banks have to pay on their securities.

The total net earnings or savings of the Banks, after paying all operating expenses, are first used each year to build and maintain required legal reserves, which are allocated to borrowers on a patronage basis. The remaining net savings are returned to the PCAs and other financing institutions using the Banks as patronage refunds.

In addition to acting as "wholesalers of credit" to PCAs, the Federal Intermediate Credit Banks also supervise them and assist them.

The supervisory functions are designed to help the Associations maintain sound and constructive credit services, to protect the investments borrowers have in the Associations, and to protect the investments made in the securities sold to obtain loan funds.

The Banks also assist the Associations by providing training for officers and directors to keep them abreast of the latest techniques and practices of credit analysis and management. The Banks offer advice and counsel on the most effective educational and promotional programs to involve members more closely in the affairs of their Associations. The Banks analyze loan programs of the Associations, help them set up their budgets, aid them in determining long range financial goals, and approve some of the larger loans.

Perhaps the single most important function performed by the Banks is that they give borrowers—through the PCAs—access to the Nation's money market and assure them of a dependable source of credit.

HISTORICAL DEVELOPMENT OF THE FARM CREDIT SYSTEM

The Production Credit Associations and Federal Intermediate Credit Banks constitute one of the three parts of the Farm Credit System. The other two are the Federal Land Banks and Federal Land Bank Associations and the Banks for Cooperatives. The System had its beginning with the passage of the Federal Farm Loan Act of 1916 which authorized the establishment and initial capitalization of the 12 Federal Land Banks. Also authorized by the Act were local National Farm Loan Associations, now called Federal Land Bank Associations.

The Land Banks were established to fill a need for a permanent and dependable source of long term agricultural credit. The Associations service loans made by the Banks.

The Land Banks now make loans of from 5 to 40 years secured by first liens on real estate to farmers and ranchers, rural residents, and selected farm related businesses. These loans are made through more than 500 local Federal Land Bank Associations.

The agricultural depression of the 1920's led to the Farm Credit Act of 1923 which authorized the establishment of the 12 Federal Intermediate Credit Banks. They were intended to discount the short and intermediate term notes of farmers given to various financing institutions. However, these institutions did not avail themselves of the services offered by the Credit Banks to the extent expected and a credit gap still existed.

To help close that gap Congress, in 1933, authorized the establishment of local Production Credit Associations which could discount with the FICBs. In effect, the PCAs became the retail outlets for credit available at wholesale from the FICBs.

In that same year, Congress authorized the establishment of 13 Banks for Cooperatives to provide a complete loan service to farmers' marketing, supply, and business service cooperatives. Twelve of these are district Banks serving the needs of cooperatives in their respective territories. The thirteenth is the Central Bank for Cooperatives which participates with the district Banks on larger loans.

An Executive Order of the President created the Farm Credit Administration and all Farm Credit institutions were placed under its supervision.

Like the Federal Land Banks, the Federal Intermediate Credit Banks, Production Credit Associations, and Banks for Cooperatives were initially capitalized by the Government. Later changes in the laws governing these institutions paved the way for them to repay the Government's investment and all are now completely owned by their borrowers.

Present authority for the activities of the Banks and Associations may be found in the Farm Credit Act of 1971 which supersedes all previous laws governing them.

BORROWERS SHARE SYSTEM CONTROL

The borrowers who share ownership of the Banks and Associations of the Farm Credit System have a voice in the control of that System from the local to national levels.

They elect the boards of directors of the local Production Credit Associations. They also elect the boards of the Federal Land Bank Associations and of the cooperatives of which they are members.

The boards of directors of the Production Credit Associations, Federal Land Bank Associations, and cooperatives owning stock in the Bank for Cooperatives in each Farm Credit district each elect two members of the district Farm Credit board. The seventh member is appointed by the Governor of the Farm Credit Administration with the advice and consent of the Federal Farm Credit Board. The district directors serve as the boards for all three Banks—Federal Land Bank, Federal Intermediate Credit Bank, and Bank for Cooperatives—in their district and as a district Farm Credit board. They set the policies for all three Banks as well as for coordinated services of the three Banks.

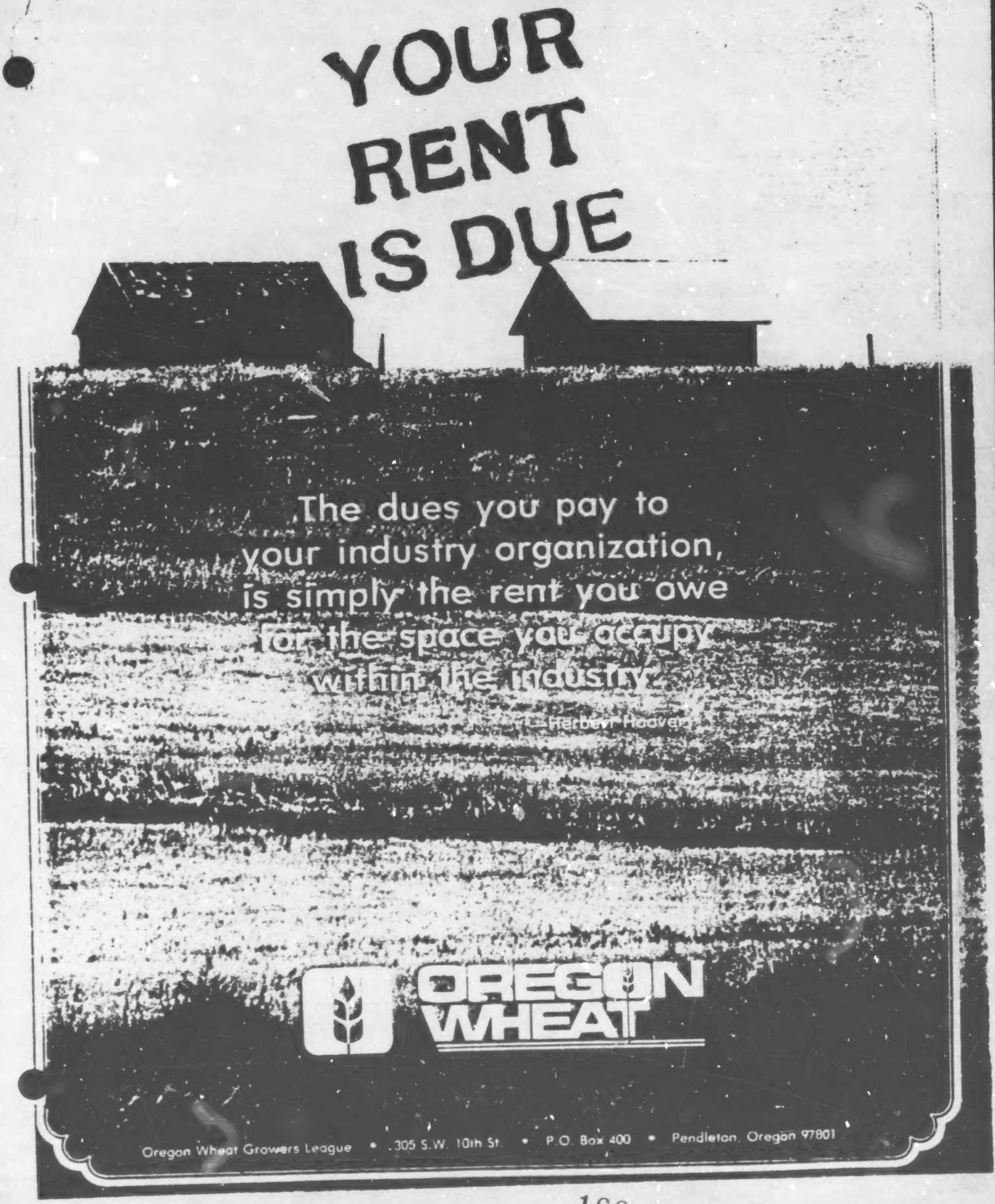
The board of directors of the Central Bank for Cooperatives is composed of one director from each Farm Credit district who is elected by the district Farm Credit board. A thirteenth member is appointed by the Governor of the Farm Credit Administration with the advice and consent of the Federal Farm Credit Board.

The boards of the local Production Credit Associations, Federal Land Bank Associations, and cooperatives holding stock in the Bank for Cooperatives in each district also make nominations for the President of the United States to consider in making appointments to the Federal Farm Credit Board. One member is appointed from each district for a six-year term and is not eligible for reappointment. Since the establishment of the Federal Farm Credit Board in 1953, all members have been appointed from among nominees. A thirteenth member of the Federal Farm Credit Board is appointed by the Secretary of Agriculture and serves at his pleasure.

The Federal Farm Credit Board serves part time and is the national policy making body for the Farm Credit System. It is responsible for the direction and supervision of the Farm Credit Administration. The Board appoints the Governor who is the chief executive of the Farm Credit Administration, the supervisory agency for the Farm Credit System.

The Banks and Associations of the System are supervised and examined by an agency of the Federal Government because they hold Federal charters. However, the unique method of democratic control by the borrowers who own and use the System assures that the supervisory body is responsive to their needs within the Federal law under which it operates.

BEST COPY AVAILABLE



YOUR RENT IS DUE

The dues you pay to
your industry organization,
is simply the rent you owe
for the space you occupy
within the industry.

—Herbert Hoover

OREGON WHEAT

Oregon Wheat Growers League • 305 S.W. 10th St. • P.O. Box 400 • Pendleton, Oregon 97801

The Purpose Of The
A Strong And Profitable

The Oregon Wheat Growers League was formed in 1926 to represent a large group of businessmen—the Oregon grain farmers.

From the beginning the OWGL goal has been to unite the growers . . . so we could work together and make us all stronger.

When farmers are rushed with field work and the business of farming, there is not time to investigate every facet of the industry.

OWGL PROGRAMS INCLUDE:

1 LEGISLATIVE

The OWGL is active in state and national activities. Areas of accomplishment include property tax reductions through farm use assessment regulations. Oregon inheritance tax laws will soon be phased out. We work hard to be sure Oregon wheat interests are represented.

2 TRANSPORTATION

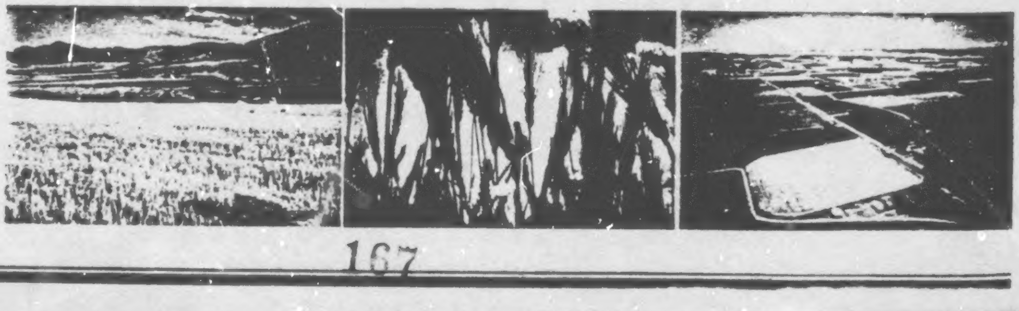
Freight costs are important to us. Rail, barge, and truck rates need to be fairly adjusted to provide a reliable means of moving our crops from field to consumer.

3 MARKETING

The OWGL started market development in Japan in the early 1950's and this work led to the formation of Western Wheat Associates. Now, nearly 80% of Oregon's wheat is exported. The demand for our white wheat has lead to a market price generally exceeding other classes of wheat. Market development is one of the important areas of attention.

4 RESEARCH

Keeping our cereal crops at peak production requires an aggressive varietal research program. The OWGL cooperates with Oregon State University to keep our wheat at high production as well as to maintain milling quality. Research on alternate crops to further improve Oregon's agricultural income is also promoted.



OWGL Is To Ensure Grain Industry In Oregon.

The OWGL is the aggressive commodity group working on the grain producers behalf.

You may already know of our accomplishments and objectives. They are listed here . . . they add up to the fact that the OWGL will take action to aggressively ensure a strong and profitable grain and agricultural industry in Oregon.

5 SAFETY AND ENVIRONMENT

2,4-D is being attacked as "unsafe" by groups that have had minimal contact with this herbicide. 2,4-D is a valuable production tool for wheat producers who have used the material safely for over 30 years. We're working aggressively to save this product and others.

6 INSURANCE

The OWGL pioneered a Worker's Compensation insurance plan through SAIF. We're still working on alternate plans to reduce the high cost of this insurance. The OWGL also offers a health insurance plan that includes growers in Idaho, Montana and North Dakota and provides competitive rates and benefits.

7 COMMUNICATIONS

We work every day with the communications media. The OWGL furnishes a weekly newsletter to all paid members of the OWGL. A weekly radio program covers Oregon outlining information for growers and consumers. Monthly publications detailing wheat information are mailed to all known wheat producers in Oregon.

8 PUBLIC RELATIONS

Activities include cooking demonstrations at various state-wide shopping centers and cooperation with consumer groups. Speakers are furnished for service clubs and organizations to explain happenings in Oregon agriculture.

9 MEMBERSHIP

Through the OWGL, Oregon's wheat farmers are members and representatives of numerous influential groups. The National Association of Wheat Growers carries our banner in Washington, D.C. (The NAWG was voted top commodity farm group by Congressional staff members). Western Wheat Associates develop markets, Agricultural Council of America, Agri-Business Council, Chambers of Commerce . . . you are represented in all areas for wheat development.

Cooperatives

Instructor's Guide:

1. The following unit is taken from the Economics, Statistics, and Cooperatives Service, Report Number 6.
2. The questions for study in each lesson are numbered in such a way that they correspond with a transparency master at the back of the unit.

Teaching Aids:

1. Economic, Statistic, and Cooperative Service, Report Number 5.

Student Activities:

1. Give students research projects to investigate various aspects of cooperatives and report back to the class.
2. Arrange a field trip to a local cooperative to increase students working knowledge of cooperatives.
3. Refer to "Suggested Assignments" listed at the end of each section as possible student activities.

Introduction Ideas:

1. Utilize guest speakers from various cooperatives to help enlighten students awareness and knowledge of cooperatives.
2. Inquire if the students realize that cooperatives contribute to their health, comfort, convenience and safety. (Health Cooperatives, Electric and Telephone Cooperatives, Farm Insurance Cooperatives.)
3. Inquire if the students realize that as FFA members, membership in a cooperative is a possibility, an advantage and a responsibility.

CONTENTS

Page

Lesson 1 - Principles and Practices *1*
Lesson 2 - Historical Cooperative Developments *13*
Lesson 3 - Economic Democracy In Action *27*
Lesson 4 - Principles Underlying Cooperative Financing and Taxation *37*
Visuals *49*
  Lesson 1 .... *50*
  Lesson 2 .... *75*
  Lesson 3 .... *102*
  Lesson 4 .... *126*

COOPERATIVE INFORMATION REPORT 6

March 1979
Slightly revised, July 1979

Foreword

Cooperative leaders, many of whom are engaged in cooperative education and personnel employment and training activities asked Economics, Statistics, and Cooperatives Service (ESCS) to prepare an instructional series on cooperatives. The series was to be designed for post-secondary schools to improve student understanding of cooperatives operating in the community. These leaders were especially interested in technical schools and institutes and community and junior colleges.

Most post-secondary schools and colleges have cooperative education programs where many of their students enter into a cooperative work program between the school or college and the business community. The student is able to study and work at the same time.

Post-secondary instructors and administrators were consulted on the need for general cooperative instruction, preparing students to make more effective use of rural cooperative work opportunities. They have expressed a continuing interest in and a desire for suitable cooperative teaching material to supplement existing general economics, business, social studies, agricultural, or other courses. Those consulted stipulated keeping the program basic and that it be divided into four areas: cooperative business organization, history, people involved, and finance and taxation.

Numerous visual aids are included for easy reproduction as transparencies to assist instructors. These same visuals, along with cooperative illustrations from local or community scenes, will introduce an innovative quality to classroom procedures and techniques.

Much can be accomplished by instructors localizing this supplement to provide the climate needed in acquainting students with what cooperatives operating in the business community are or are not, and the opportunities afforded for a satisfying and mentally rewarding place to make a career.

Objectives are stated at the outset of each unit. Likewise, at the end of each unit there are suggested assignments for students as individuals or in group activity.

UNDERSTANDING YOUR COOPERATIVES

C. H. Kirkman, Jr.
Cooperative Management Division
Economics, Statistics, and Cooperatives Service

PRINCIPLES AND PRACTICES

LESSON 1

Understanding your cooperatives

Objectives

- — Develop an understanding of the cooperative business.
- — Identify cooperatives in the community and services they provide.

1-1. What Does Cooperation Mean?

Cooperation means the voluntary act or operation of joining resources—physical, mental, and material (including capital)—to achieve an end. Physical or natural resources above, on, or under the land and sea surface provide the basis for producing the commodities for everyday living. Nothing happens to the physical resources until the human resources of labor and management use material, capital, or an aggregation of other goods to develop them into useful and enjoyable products.

1-2. Why Cooperate?

People cooperate to gain a mutual benefit for themselves and others. People work together to accomplish something that probably could not be done individually. They work together when they see that collective effort will make it easier to solve problems or perform a certain job. They may want to add to their income, reduce expenses, or provide more efficient, economical, and dependable services not readily available in their community.

1-3. What Are Two Basic Types Of Cooperation?

Two basic types of cooperation are informal or unstructured and formally organized. Informal or unstructured cooperation starts with two or more people starting a joint effort to perform a certain job or supply needed goods and services.

Formally organized organizations evolve when people discover that informal or temporary arrangements are unable to perform the job, attain the services, or maximize the benefits or efficiencies desired.

Some formal organizations are established as nonbusiness or nonprofit entities such as churches, schools, recreation facilities, farm organizations, community kindergartens or others. These formal nonbusiness organizations may be chartered under a special State statute for this purpose.

Other formal organizations are established for strictly business purposes, such as banks and credit unions to provide or perform services for pay. When more than a few people (usually 3 to 5) are involved, most States have statutes under which business organizations are chartered. When people formally organize businesses to market their own products, purchase their supplies, or provide themselves services, they charter under a separate statute in most States, provided for cooperative corporations.

1-4. What Is A Cooperative Business?

A cooperative is a business voluntarily owned and controlled by its users and operated for them on a nonprofit basis.

Cooperative understanding and definitions are as varied as the aspects of the cooperatives and the background and viewpoints of people making them. Some are all-inclusive, others emphasize particular aspects such as economics, social, or legal phases. An additional definition will help you understand the nature and objectives of cooperatives. For example: "A cooperative is a voluntary contractual organization of persons having a mutual ownership interest in providing themselves a needed service(s) on a nonprofit basis. It is usually organized as a legal entity to accomplish an economic objective through joint participation of its members. In a cooperative, the investment and operational risks, benefits gained, or losses incurred are shared equitably by its members in proportion to their use of the cooperative's services. A cooperative is democratically controlled by its members on the basis of their status as member-users and not as investors in the capital structure of the cooperative."[1]

1-5. What Does A Cooperative Do?

A cooperative provides its user-owners goods and services at cost of operations.

Cooperative enterprises belong to people who use their services, the control of which rests with all members, and gains of which are distributed to members in proportion to the use they make of services provided. Cooperatives are business organizations usually incorporated, owned, and controlled by members or stockholders as patrons. They operate on a cost basis after allowing for expenses of operation and maintenance and any other authorized deductions for expansion and necessary reserves.

The basic purpose of cooperatives is to give groups of people opportunity to serve their own needs and solve their own problems more effectively than when acting individually.

---

[1] USDA's definition of a cooperative in Cooperative Criteria, Farmer Cooperative Serv., Serv. Rpt. 71, Feb. 1965.

1-6(A). Where Does A Cooperative Fit In The American Private Competitive Enterprise System?

As business organizations, cooperatives are a method of doing business under the American private competitive enterprise system. Cooperatives are usually incorporated. Incorporated cooperatives are classified in our American business enterprise system as one form of corporation—a member-user-owned cooperative corporation.

Methods of doing business under the American private competitive enterprise system are conducted by three types of legal business firms: (1) Individual ownership, (2) partnership, and (3) corporate form. The corporate form of business is divided into two kinds—investor-owned corporation and member-user-owned cooperative corporation.

In an investor-oriented corporation people, called investors, invest their money to obtain a profit from service to others called customers. In a cooperative-oriented corporation, people, called members, invest their money to obtain services for themselves. Members are the investors and the customers, called patrons, in a cooperative corporation.

1-6(B). What Are The Features Of The Methods Of Doing Business?

(Optional. Use information on chart for discussion)

1-7. How Is A Cooperative Like Other Businesses?

Cooperative businesses are like other corporate business organizations in physical appearance, functions or services performed, and operations based on sound business practices.

Cooperative corporations physically resemble other corporate forms that perform similar services. They employ personnel with like training to perform similar jobs. They usually charge the same price for items bought and may pay the same market prices for products marketed by members through them. The owners elect a board of directors. The board hires a manager and makes general policies. The manager runs the day to day business and must use sound business practices for the cooperative to survive as a useful organization for members.

1-8. How Is A Cooperative Distinctive?

Agricultural cooperatives have five distinctive features. The first distinctive feature is democratic member-user control.

For a farmer cooperative to come within the protection of the Capper-Volstead Act, it must either limit annual dividends on stock or membership capital, *or* restrict voting rights to one-member, one-vote.

It is fundamental that those who use and benefit from the organization must own and control the business. Otherwise, the benefits members are seeking may not materialize. Member-users of a cooperative corporation in most instances have one vote, no matter how much they have invested in it, or how much they may patronize, that is, use the organization.

This characteristic, however, is not indispensable. In some cooperatives, the basic membership vote is supplemented to permit additional votes based on the previous year's patronage in dollars, or volume such as hundred pounds of milk, or cartons of fruit marketed. In a few cases, a maximum number of votes, such as 5 to 10 is established. This voting procedure is in contrast to regular corporations that allow voting power in proportion to shares of stock owned, or voting power in proportion to investment.

The democratic principle is steadfastly maintained by relating voting power to use of the cooperative's services. The member as a voluntary participant using the cooperative usually has a greater interest in its progress and success.

Members vote to elect the board of directors at the annual membership meeting. This gives members a voice in controlling the business they own and use, because directors represent members. Directors decide policy and are responsible to the members for efficient operation of their cooperative. The board of directors hires a manager as in all corporate firms.

1-9. How Is A Cooperative Distinctive?

The second distinctive feature is service at cost.

This is also called operation at cost. Any net savings, called profit or net income in investor-owned corporate firms, made after paying expenses belongs to the members patronizing the cooperative. It is divided at yearend among the member-users according to the amount of business each does with the cooperative.

When the net margin is returned to member-users, it is known as a patronage refund. At least 20 percent of patronage refunds by law must be returned to patrons in cash. Remaining portions may be allocated to each patron's account when retained by the cooperative to provide additional capital.

The cooperative organization papers—including bylaws and marketing contracts—usually contain provisions obligating the return of margins in excess of cost to its member-users. This legally binding contract is in effect before any transaction takes place; thus the net margin never becomes corporate income. This net margin belongs to the member-users.

Because cost cannot be estimated accurately in advance, patrons of cooperatives usually pay the "going or competitive price" for goods or services purchased and generally receive an advance for products marketed by their cooperatives less than the actual value of the product. Adjustments are made at the end of the year when costs are known and the amount of any necessary adjustment is then returned to member-patrons. When cooperatives return or allocate all net margins to patrons they are, in effect, adjusting operations to a cost basis. The patronage refund is not taxed as corporate income.

Federal income tax laws of this country set up certain criteria that cooperatives must adhere to so tax obligations are met at either the cooperative or patron level.

Patronage refunds derived from marketing products or obtaining production supplies are, by contract, member income. These patronage refunds are listed on each member's personal income tax form for taxation.

Patronage refunds are a convenient means of helping members finance cooperatives. The portions not distributed in cash are often issued in noncash form as certificates or other forms of evidence of ownership to show members have certain amounts of accumulated capital credited to them. When sufficient capital is built up, these certificates may be redeemed in the order issued.

Some cooperatives do not distribute patronage refunds on the same basis to both members and nonmembers. When business is transacted with nonmembers, these cooperatives may return patronage refunds only to members. Others distribute to nonmembers but at a lower rate.

To the extent that members receive patronage refunds derived from business done with nonmembers, the cooperative has realized a business profit. Under these circumstances, patronage refunds to members may include elements of corporate net income, which is taxable. However, many cooperatives strictly adhere to the operation-at-cost principle and distribute refunds to all patrons at the same rate.

1-10. How Is A Cooperative Distinctive?

The third distinctive feature is limited returns on money members invest in their cooperatives.

Capital is as necessary in cooperative businesses as in other firms. However, capital invested in cooperatives is only a means to an end. Members of cooperatives are interested primarily in advantages they derive as patrons of the organization—not as an outlet or place to invest capital at a high rate of return.

Because benefits in cooperatives are distributed to patrons on the basis of their use of services, such benefits do not enhance the value of shares of stock or provide a return on invested capital.

Members of cooperatives must provide most of this capital for operating funds and facilities either by direct subscription or by investment of their patronage allocations. For this reason, the equity capital of cooperatives comes, for the most part, only from member-patrons.

Limitation by cooperatives of returns on capital is recognized in both Federal and State laws. These laws specify the maximum returns that may be paid on invested capital. Cooperatives may choose to pay any amount less than the maximum. In most State statutes, the limit on capital returns is fixed at 8 percent, although in a few States, it is lower or higher. The basic Federal cooperative law—The Capper-Volstead Act—recognized the principle of limited returns on capital by setting a maximum dividend rate of 8 percent per year if members vote on any basis other than one-member, one-vote.

Agricultural cooperatives that qualify under Section 521 of the Internal Revenue Code are required to limit dividends on their capital stock to 8 percent a year or the legal rate of interest in the State of incorporation, whichever is the greater. This legislative recognition of the limitation of returns on capital in a cooperative business enterprise provides legal sanction to a business procedure already recognized as sound among cooperatives.

1-11. How Is A Cooperative Distinctive?

The fourth distinctive feature is that the cooperative is member-owned and financed.

People forming cooperatives are owners. Owners not only invest their money in the business, but they also agree to use the cooperative's services.

People who want to remain independent, to own and operate their own business firms, and to increase their earnings as much as possible are interested in cooperative membership.

In a cooperative, many people with similar problems, interests, and desires can join together to combine their investment and influence in a business or service field. They retain their right of individual ownership and decisionmaking, and at the same time enjoy the advantage of mutual effort on pooling their resources to obtain needed services.

Cooperative owners are called members, member-patrons, or member-owner-users.

There is a tendency to associate farmers with cooperatives. Actually, both farmers and city people use and are benefited by cooperatives.

1-12. How Is A Cooperative Distinctive?

The fifth distinctive feature is that operations are limited.

The Capper-Volstead Act provides farmers "may act together" in collectively marketing their products in their own association and also by joining with other associations of producers to have a common marketing agency. This is generally known as limited antitrust exemption to producers.

The act establishes certain limitations an association of producers must meet to qualify for such exemption. An association must be operated for the mutual benefit of its members insofar as they are producers of agricultural products. Second, an association must not deal in products of nonmembers in an amount greater in value than such products that it handles for its members.

The Capper-Volstead Act also protects the general public by limiting the possibility of undue price enhancement as a result of any monopoly position that a group of producers could legally achieve by getting together.

Adherence to the five distinctive features discussed will not in itself guarantee success to any cooperative organization. There is no business magic in cooperation itself. It merely enables members to legally operate in business in such a way that benefits achieved come to them.

1-13. What Are The Advantages Of A Cooperative Over Other Forms Of Business?

Cooperatives have certain advantages over other forms of business. Some of these have been suggested in the distinctive features. To the extent that cooperatives are able to use these distinctive features for benefit of members, they become business advantages.

Service or operation at cost is a key feature in tying benefits to use of the organization. While other firms seek to make a profit for the benefit of investors, cooperatives seek to provide services that result in increased net income for their member-users. Members using the organization most logically become those who benefit most from using the services.

Democratic member control, or restricting voting rights to one-member, one-vote, as set forth in the Capper-Volstead Act, provides that member control is shared equally. The act of voting on an equal basis with other members helps those persons desiring to retain independance feel greater involvement in the cooperative business.

The distinctive feature of limited returns on investment, also provided in the Capper-Volstead Act, plus voting on a basis other than investment, makes successful cooperatives safe from outside takeover. Profit incentives that cause persons to invest in corporate stocks are not present in cooperative stocks. Strict adherence to this characteristic of limited returns has not always been easy. In some instances, early farmer associations drifted into hands of individuals or groups other than cooperatives because control was based on capital with no limit placed on the amount of returns on that capital.

1-14. What Are The Disadvantages Of A Cooperative?

Cooperatives have certain disadvantages compared with other forms of business.

The distinctive feature of limited returns on investment means sources of cooperative financing usually are limited to direct member subscription and investment of patronage allocations. The cooperative uses member investments as security in borrowing additional capital from banks, including Banks for Cooperatives, and other lending agencies.

A second disadvantage is the need to educate members. Because cooperatives do have distinctive features, member-owners need to understand these features and explain them to others. Members must be provided both good and bad facts by their cooperative—what it is, how it functions, what are its problems, and options or choices they have when voting in meetings. After members get information by newsletter, newspaper or magazine, at meetings, or through personal contact, they must have opportunity to ask questions, and express their desires and opinions to the cooperatives' board and management. Adequate funds to conduct required educational programs must be allocated.

A third disadvantage of agricultural cooperatives is based on another distinctive feature—limited scope of operation. The association must benefit members and is limited in the amount of business it can do with nonmembers. Thus, possibilities of expansion are limited to membership growth and member business.

1-15. How Are Cooperatives Organized?

Cooperative classification is often difficult because cooperatives are involved in most any activity. A logical and practical classification for cooperatives requires various approaches—organization, type, and legal status.

Cooperative organization is based on membership. Those associations serving relatively restricted areas may be centralized local or regional cooperatives.

Centralized local cooperatives have individuals as members. The members usually live within a well-defined area. Membership, for example, may be restricted to an area that grows a particular kind of crop, or consist of employees of a business organization sponsoring a credit union, or live in a housing cooperative, or reside in a geographic trade area comprising one or several counties. Local associations may be completely independent or they may affiliate with one or more other cooperatives.

Centralized regional cooperatives are often expanded local cooperatives with a number of outlets covering a larger area. Individuals are members of centralized cooperatives just as they are in locals. Centralized cooperatives have one central office, one board of directors, and one general manager responsible for the entire operation, although several or many branch offices may be involved. They may serve patrons within the relatively restricted membership area of a single State or several States.

1-16. How Are Cooperatives Organized?

A second member organization approach is the federated regional cooperative.

Federated regional cooperatives are actually cooperatives of cooperatives. Members usually are local cooperatives, operated by local managers appointed by and responsible to local boards of directors. Each local cooperative in a federated cooperative is a separate corporate entity. The local cooperative holds the voting stock rather than individuals.

Federated cooperatives, often called federations, have their own general manager and staff. The board of directors is elected by and represents local affiliated cooperatives.

While local cooperatives are independent in organization and operation, they depend in varying degree on the federated regional for a variety of services. Some federated cooperatives in practice may appear much like centralized cooperatives, depending on added services, activities, or responsibilities they contract with locals. These may include credit or financing arrangements, distributing supplies direct to individual members of locals, management contracts, accounting procedures, and educational programs.

Federated regionals may furnish marketing, processing, arranging and coordinating shipments, and handling of surplus products; maintain product standards; use market contracts; and do product promotion for local cooperatives.

Federated regional purchasing cooperatives may procure supplies in large volumes, engage in manufacturing, conduct research, and provide various related services, such as financing, data processing, and insurance. Federated regionals may provide only services, such as financing, data processing, advertising promotion, employee training, education, legislative affairs and others.

Members owning and controlling local cooperatives are the principal beneficiaries of federated operations.

1-17. How Are Cooperatives Organized?

A third member organization is called a mixed cooperative.

Mixed or hybrid cooperatives frequently develop among federations. Large producers become members along with local cooperatives. In some cases many individuals may be served through branches. Sometimes small federations and locals become members of larger federations. Federated and centralized regionals may also form federations called interregional or national cooperatives.

1-18. What Types Of Cooperatives Are Operating?

Cooperative operations or functions performed are a method of classifying associations. Cooperative operations differ from each other in the way members use them: purchasing production supplies, marketing what they grow or produce, and providing a wide range of services. Many cooperatives perform a combination of either or all of these functions.

1-19. What Does A Purchasing Cooperative Do?

Purchasing cooperatives, often called production supply, farm supply or supply cooperatives, provide farmer-members with the many inputs they need for their farm operations. Major items include feed, fertilizer, and petroleum products, while smaller volume items include seed, pesticides, building material, and others.

Most cooperatives have in some way affiliated with other cooperatives, often through national and international federated cooperatives in efforts to reduce farmer costs. Through federated cooperatives, they may establish plants to manufacture or process paint, batteries, tires, small tools, feed petroleum, pesticides and other products; or they may purchase products in large volume or in the natural state such as phosphate, process them, and manufacture them into fertilizer materials. Distribution to producer members is a major concern at the local level because added services are needed.

1-20. What Does A Marketing Cooperative Do?

Marketing cooperatives, at the first handler level, market about one-third of all products farmers sell. Marketing cooperatives are organized to market any of the many products farmers produce—dairy, fruit, vegetables, grain, livestock, rice, forest products, and many specialty products. Farmers may sell their products through their marketing cooperative as raw products. Other cooperatives construct or purchase facilities to process the raw products of members. For example, a citrus cooperative may own and operate juicers, evaporators, and freezers to process members' fruit. Some marketing cooperatives, such as dairy, poultry, and livestock, process and retail their members' products.

1-21. What Does A Service Cooperative Do?

Service cooperatives provide services related to the production and marketing of farm commodities, or they may provided general services.

Related service cooperatives perform services that affect location, form, or quality of the farm products or supplies handled for members. Services may be part of the operation or they may be performed by separate cooperatives. Examples of services related to handling farm supplies are trucking; applying fertilizer, lime, or pesticides; harvesting; grinding; and feed mixing; plus many more.

General service cooperatives provide a number of specialized services assisting farmer members in their business. Credit is provided through the Farm Credit System and credit unions for rural residences. Rural electric and telephone cooperatives provide their respective services. A long list of insurance cooperatives, mutual irrigation cooperatives, dairy herd improvement associations, artifical breeding cooperatives, research cooperatives, pest management cooperatives, grove care cooperatives and many more exists.

1-22. What Are Cooperatives' Legal Status?

Legally, cooperatives are classified as unincorporated and incorporated and whether set up on a stock or nonstock plan.

Unincorporated cooperatives have a legal status somewhat similar to a partnership. They are usually small, informally operated, and require few facilities or little capital.

Cooperative business ventures are generally incorporated under special cooperative State statutes. While cooperatives have distinct features, they are as much a corporation as any other business corporation.

In incorporated cooperatives organized on a stock basis, members receive stock certificates as evidence of their ownership interest in the cooperatives. If the organization is organized on a nonstock basis, certificates are issued to show membership and others are issued to evidence capital contributions. The latter are often revolving fund certificates. Many nonstock cooperatives raise original member capital through collecting membership fees. It still takes member capital to operate a cooperative business regardless of legal and financial structure.

1-23. What Are Cooperatives' Legal Foundations?

Cooperatives' legal foundations lie in the Capper-Volstead Act and the State statutes that they use for chartering.

The Capper-Volstead Act, discussed in some detail under the distinctive cooperative features, was enacted in 1922. The act entitled, "An Act to Authorize Association of Agricultural Producers" gave agricultural producers permission to act together to collectively market their products. The act also spelled out in considerable detail the requirements a cooperative must meet to maintain the protection afforded by it. Abrahamsen[1] summarizes the major provisions of the act as follows:

---

[1] Martin A. Abrahamsen. Cooperative Business Enterprise. 1976. McGraw-Hill, Inc. pp. 195-196.

"The cooperative must operate for the mutual benefit of members.

"Members can be only farmers, planters, ranchmen, dairymen, nut or fruit growers.

"A cooperative, to obtain the protection of the act, must operate so that nonmember business does not exceed member business, and either (1) no member shall be allowed more than one vote because of amount of stock or membership capital he owns, or (2) dividends on stock and member capital cannot be in excess of 8 percent.

"A cooperative may be incorporated or nonincorporated.

"A cooperative may be organized on a stock or a membership basis.

"A cooperative may have marketing agencies in common.

"The cooperative may engage in processing.

"Only marketing cooperatives are covered by the act.

"Consumers are protected from unreasonable price enhancement by cooperatives under provisions of section 2."

Every State has one or more statutes authorizing formation of cooperative corporations. Some States provide for agricultural cooperatives, nonagricultural cooperatives, and nonprofit organizations. In some cases, it may be more feasible to incorporate under the regular incorporation laws of the State and establish bylaws to operate as a cooperative.

These laws specify the type of information that must be included in the articles of incorporation and designate the official with whom the articles must be filed. Copies of these laws can be obtained from the proper State official, usually the Secretary of State or Corporation Commissioner.

Suggested Assignment

— Make a study and report on the organization, operations, and services of the cooperative that is cooperating in your work experience assignment, or of a cooperative in the community.

Selected References

Cooperative Principles and Legal Foundations, Martin A. Abrahamsen, et.al., Section I, Cooperative Information Report 1, 1977, 26 pp., Economics, Statistics, and Cooperative Service, U.S. Department of Agriculture, Washington, D.C. 20250.

Cooperatives in Agribusiness, C.H. Kirkman, Jr., Cooperative Information Report 5, 1978, 59 pp., Economics, Statistics, and Cooperatives Service, U.S. Department of Agriculture, Washington D.C. 20250.

Cooperative Business Enterprises, Martin A. Abrahamsen, 1976, 491 pp., McGraw-Hill, Inc.

How We Organize to Do Business in America, 1973, 29 pp., American Institute of Cooperation, 1800 Massachusetts Ave. N.W. Washington, D.C. 20036.

Films

"How People Do Business in Our Democracy," 1974, 18 minutes, 16 mm, sound, color, American Institute of Cooperation. Available through regional cooperatives, Farm Credit Banks, or State cooperative councils.

"Cooperatives—The Farmers' Way," 1975, 24 minutes, 16 mm, sound, color, Economics, Statistics, and Cooperatives Service and American Institute of Cooperation. Available through regional cooperatives, Farm Credit Banks, State cooperative councils, or land grant university libraries.

HISTORICAL COOPERATIVE DEVELOPMENTS

LESSON 2

Understanding your cooperatives

Objectives

--Understanding the development of cooperatives and their legislative support in the United States.

—Understanding cooperative development and legislation affecting cooperatives in your State.

—Learning the extent of present farmer cooperative activity in the United States.

2-1. What Were Early Forms Of Cooperation In This Country?

Cooperative history has deep roots in the United States with a rich heritage beginning with early American colonies. Pilgrim and other early colonial history refers to people working together to get things done. Colonial activities included land and road building, house and barn raising, threshing rings, corn husking bees, community protection, and many other forms of group activity.

Settlers worked together. Those moving west cut trees for openings for early roads. Farmers cut trees and rolled the logs to make openings for crops. Stones were carried from fields and the larger ones cracked and placed in the roads for foundations to prevent wagons from miring in mud.

Early settlers cooperated to make their lives more comfortable and safer. Men with strong arms raised logs for log cabins, barns, and stockades. Others with sharp axes notched the logs at the ends to fit in place at the corners.

Farmers formed threshing rings that moved from neighbor to neighbor to thresh the grain. Women worked together preparing big meals for the workers.

Corn husking bees were one of the more enjoyable of these work-sharing events. Youth and adults met at each farm to husk corn. Frequently cider was served and square dancing followed the husking. Young men finding a red ear of corn won the right to kiss a pretty girl.

Sharing labor and resources on farms and providing community protection are as old as American agriculture. These activities were a natural foundation for the development for today's cooperatives.

2-2. How Did Early Cooperative Business Activity Develop?

(A) Earliest purchasing cooperative efforts were informal. Farmers in neighborhoods would get together and pool orders to purchase carloads of supplies—seed, feed, fertilizer, salt, twine, flour, and others. They handled supplies themselves direct from railroad cars to keep costs down.

Farmers looked to cooperatives for markets as they produced more than their families could use. Fruit on the West Coast was an example.

Cooperatives were put on a business basis by farmer participation in buying, marketing and service activities. Formal cooperatives incorporated, elected directors, employed managers, and acquired facilities. Through trial and error, sound business principles and techniques evolved.

(B) Neighbors worked together during time of disaster such as fire or storm. They organized to put out fires by passing buckets of water from person to person. Often the community worked together to repair storm damage or build a new house. Incorporated mutual insurance services developed from these informal efforts.

2-3. What Were Some Of The Earliest Cooperative Businesses?

Benjamin Franklin's efforts to organize mutual insurance companies in the United States date to the mid-18th century. While he worked with Workman's Protective Association of Philadelphia earlier, his efforts in 1752 with the Philadelphia Contributorship for the Insurance of Homes from Loss of Fire and Other Hazards are widely recognized. These early mutual insurance companies were local in nature and emphasized low-cost insurance protection.

2-4. Early Cooperative Of Special Note

The 28 poor weavers living in a factory town are acclaimed widely for establishing the first permanent cooperative in England in 1844. Desperate over poor pay and high living costs, they opened a cooperative grocery store on Toad Lane in Rochdale. This store thrived and grew, inspiring other similar activities in all parts of the world.

They drew on the experience of other pioneer cooperatives in developing their ideas and operating practices. From their practical operating experience they developed the Rochdale principles accepted today by many people as the distinguishing trademarks of cooperative business.

2-5. Early Cooperatives

California citrus growers made their earliest attempt to unite to market fruit by organizing the Orange Growers Protective Union of Southern California in 1885. The Union sent salaried employees to eastern markets to oversee distribution of members' fruit. It did not require holders to use its buying, selling, and shipping services, so the Union lacked organization and coordination. After a few years, it ceased operating; it was revived again briefly in 1890, only to disband in 1893.

Three other organizations attempting to harmonize grower and packer interest were formed about the same time as was the Union. These attempts to deal with divergent interests of growers and packers within a single organization soon failed.

Continued cooperative organization attempts were made to overcome marketing problems. They faced antagonism of fruit brokers and commission men, friction between officials attempting to work together, large crops, low returns, and violations of the principle of local democratic control.

Basic cooperative principles adopted with formal incorporation of California Fruit Growers Exchange in 1905 are in effect today. The corporate name was changed to Sunkist Growers, Inc., in 1952 to more definitely associate the Sunkist trademark with the organization.[1]

2-6. Early Cooperatives

Other producers tackled their own problems by forming organizations that were cooperative in purpose and character, if not entirely so in structure. Many efforts were pursued, not as reform measures, but rather as steps to open commercial channels not yet developed.

In Ohio, for example, Miami Exporting Company was organized in 1803 as the first formal farmer cooperative to find markets for the farm products of the State. This cooperative, aimed chiefly at giving assistance to farmers, was composed of both farmer and merchant members.

The first known local cooperative handling farm supplies started at Riverhead, Long Island, in 1863 to buy fertilizer wholesale for members near New York City. This association operated on a cash basis, requiring gold to order and purchase fertilizer materials.

2-7. Early Cooperatives

(A) Little is known about earliest cooperative dairy marketing efforts, but a cooperative creamery formed about 1810 at Goshen, Conn., made history as the pioneering attempt. About the same time, a cheese plant was begun at South Trenton, N.Y.

Probably the outstanding example of an early cheese factory was one established in 1851 in Oneida County, N.Y. This successful effort was followed by the first cooperative butter manufacturing factory in 1856 at Campbell Hall, N.Y.

Cheese, butter plants, and creameries proved popular and successful. Dairymen set examples in early cooperative activity and had established more than 400 cooperative dairy processing plants by 1867.

A group of Welsh farmers organized the Licking Exporting Company near Granville, Ohio, in 1820. This first cooperative hog marketing venture collected the live animals and drove them to Sandusky for slaughter and packing. An agent of the cooperative accompanied the pork product by boat to Montreal to handle sales. These efforts proved unprofitable.

However, 17 farmers in Bureau County, Ill., had more success. During 1 week of operation in 1860, their fourth year of cooperation, farmers brought 504 dressed hogs for sale on the Chicago market.

Other livestock shipping associations developed rapidly. They enabled producers with less than a carload to sell on terminal markets by making up a carload with neighbors, thus contributing to success.

---

[1] The Sunkist Adventure. C. H. Kirkman, Jr. FCS Information 94. 1975. pp. 9-12.

(B) The first known grain elevator was started in 1857 at Madison, Wis. Fruit Growers Union and Cooperative Society was the first association for cooperative fruit marketing. Formed at Hammonton, N.J., in 1867, it expanded to include cooperative purchasing in 1884. It continued operation with the same name until 1897.

In 1874, the Illinois State Grange made the earliest recorded effort to establish a cooperative to market poultry and other farm products. This venture was short-lived and nearly 20 years lapsed before poultry producers made another effort at cooperative marketing.

Many early cooperative business ventures blazed new trails and then disappeared after they had filled the need justifying their organization.

2-8. Where Did Early Leadership Develop?

A group of frugal Scotch farmers in North Carolina is reported to have inspired the formation of the Grange. Through their association they endeavored to purchase wholesale for a small membership.

Their meager efforts inspired Oliver Hudson Kelley, then a Government clerk checking war-ravaged southern farms. Kelley envisioned a fraternal organization as a means of improving social and economic conditions of farmers. With six fellow Government clerks, he founded the National Grange of Patrons and Husbandry.

While the National Grange used political influence, local-level cooperative selling and buying became a primary activity and grew rapidly. Orders for supplies were combined and volume transactions were made with jobbers and manufacturers at savings. Pooling of farm products for shipment to large markets occurred, bypassing tolls of commission men and dealers.

This success led to establishment of cooperative stores at State and national level agencies. Minnesota established the first State agency, 2 years before Grange founders approved the first agent appointment in 1869. Five years later, 1874, 26 States had functioning business agencies. These agencies varied widely in operation.

Iowa was among the most successful, affording large savings on purchases and increased monetary returns on direct grain and livestock shipments to Chicago. However, an ill-fated venture in manufacturing bankrupted this State agency. Similar situations occurred in other States, including Nebraska. In a serious effort to establish sound business practices, the 1875 National Grange annual meeting adopted "Rules for Patrons' Cooperative Associations of the Order of Patrons of Husbandry and Directions for Organizing Such Associations." These "Rules" of Cooperation gave new hope for cooperative effort that probably should be credited with helping save Grange cooperatives' endeavors.

These rules incorporated principles from the Rochdale Plan of Cooperation—limited the number of shares available to patrons, limited the rate of interest per share, limited the vote of each shareholder to one, emphasized the need for cash sales at prevailing prices, and required distribution of savings in proportion to patronage.

One of the largest independent cooperatives developing from Grange efforts was GLF (Grange League Federation Cooperative Exchange) Ithaca, N.Y., serving members in New York, New Jersey, and Pennsylvania. GLF is now Agway.

Grange Life and Auto Insurance, still in existence, was a success from the outset.[2]

The American Society of Equity credited J. A. Everitt, an Indiana farm paper editor, with being the chief organizer of its formation in 1902. Everitt enthusiastically promoted his thesis that organized farmers could garner justified economic benefits and equal the role of either of the other two powers—business and labor.

Equity organized many cooperative enterprises in the North Central States in spring wheat, livestock, potatoes, and general farm produce.

An early test of Equity theories came with an invitation to organize Kentucky burley tobacco growers. Favorable prices of 17 to 20 cents per pound were obtained in 1908 through reducing production to 10 percent of normal. This favorable price was a temporary economic victory because violence and intimidation aroused indignation of law-abiding citizens.

Equity grain elevators were promoted in Montana, Minnesota, and North Dakota, but expected support did not materialize. Equity influence became centered in Wisconsin where a number of livestock and farm supply cooperatives continue to carry the word "Equity" in their names.[3]

2-9. Early Leadership

A local newspaper publisher and editor, Isaac Newton Gresham, founded the Farmers Union in Raines County, Tex., in 1902. By 1905, it was functioning as a national organization and placed major emphasis on cooperative business enterprises.

Charles S. Barrett became president in 1906 and early recognized difficulties in union-operated cotton warehouses. The business-agent system for purchasing farm supplies for members of locals was hampered by lack of cash. To develop a stronger national base, efforts moved to the Midwest with emphasis on cooperative creameries, grain elevators, and livestock shipping associations.

Earliest Midwest success occurred in Kansas, Missouri, and Nebraska. By 1920, activities spread to South Dakota and included flour mills and cooperative telephone companies. About this same time, the Union made cooperative headway in Iowa. The Farmers Union State Exchange, headquartered in Omaha, flourished.

Important grain-marketing achievements were accomplished by the cooperatives now known as the Farmers Union Grain Terminal Association, Minneapolis, and Union Equity Cooperative Exchange, Enid, Okla.

CENEX, St. Paul, Minn., was formed as Farmers Union Exchange to handle farm supplies for affiliates of the terminal association. As business grew, the holding company relationship was dissolved and the name changed to Farmers Union Central Exchange before becoming CENEX.

Farmers Union entered the insurance business in Colorado, soon followed by Nebraska. It continues life, automobile, casualty, and fire insurance sales with a history of low premium rates.[4]

American Farm Bureau Federation, founded in 1919, stepped into a void, except for Farmers Union efforts in the Northwest. It soon became spokesman for organized agriculture and champion of interest in farmer cooperatives. Many Farm Bureau leaders supported and adopted the idea of large national organizations supported by Aaron Sapiro.

---

[2] Martin Abrahamsen and Claud Scroggs. Agricultural Cooperation. University of Minnesota. 1957. pp. 10-15.

[3] Agricultural Cooperation. pp. 22-25.

[4] Agricultural Cooperation. pp. 25-30.

Special commodity committees were appointed to prepare plans and make recommendations for cooperative marketing agencies to handle grain, livestock, fruits and vegetables, wool, and eggs. Grain, livestock, and fruits and vegetables established national associations. They decided existing dairy efforts were effective. In cotton marketing, the Farm Bureau supported the American Cotton Growers Exchange operating in Arizona, Texas, and Oklahoma.

In April 1923, Farm Bureau hired Aaron Sapiro as legal adviser for cooperative marketing. He was already legal counsel for many of the new commodity cooperatives and a speaker of remarkable persuasive talent. A difference in ideas and strategy developed among Farm Bureau leaders. It became so intense that Indiana State Farm Bureau withdrew membership for a period.

Upon review of Farm Bureau policy with 9 of 12 members new on the executive committee, Farm Bureau ended its action programs in cooperative marketing. Edward A. O'Neal, a retained member of the executive committee, and later president, insisted Farm Bureau return to fundamentals—field service, legislation, research, and transportation.

The national headquarters became the adviser to affiliated State and local cooperative associations that continued to make outstanding achievements in marketing and purchasing farm supplies in many States. Farm Bureau companies offering various types of insurance have shown remarkable growth. Probably the greatest Farm Bureau insurance success story is Nationwide Insurance Companies started in 1926 by Ohio State Farm Bureau with Murray D. Lincoln as founder and first president.[5]

Examples of Farm Bureau sponsored cooperatives include Landmark, Columbus, Ohio; Indiana Farm Bureau Cooperative Association, Indianapolis, Ind.; and Illinois Agricultural Association, Bloomington, Ill. County cooperatives are members of these regional cooperatives. The regionals have then established the interregional cooperatives for obtaining supplies or providing farmers markets for their products.

2-10. What Differing Schools Of Thought Developed?

Aaron Sapiro became a national cooperative figure during the twenties in promoting the Sapiro plan. He specialized in organizational structures and marketing contracts. The slogan of the day became orderly commodity marketing and was referred to as "The Legal Monopoly."

His plan dispensed with local associations. Farmers became direct members of a centralized association through purchase of membership certificates or shares of stock and through signing ironclad long-term marketing contracts. Control and authority were vested in the headquarters organization. The plan was aimed at controlling large segments of the market supply, so cooperatives would have monopolistic power.

His hypnotic speech at Montgomery, Ala., in April 1920 inspired efforts to apply the Sapiro method to State and regional single-commodity cooperatives for marketing cotton, tobacco, wheat, peanuts, white potatoes, sweet potatoes, rice, olives, milk, melons, alfalfa, and poultry. In speaking to farmers, he reduced his economic philosophy to simple terms—a monopolistic concept or enough control of the supply so as to fix or influence price. His concept proved difficult to apply in practice because he overlooked membership and overemphasized the legal aspects.

Irrespective of difficulties, his plan is reflected in many centralized cooperatives today.

---

[5] Agricultural Cooperation. pp. 30-39.

2-11. Schools Of Thought

Edwin G. Nourse, one of the founders of American Institute of Cooperation, believed the Rochdale principles ought to be reexamined in light of changing agricultural conditions. He emphasized the role of marketing cooperatives with the central ideas of democratic control, limited returns on equity capital, and distribution of savings to members on the basis of their patronage.

His greatest contributions to cooperative thinking were his emphases on business efficiency, equitable distribution of control and benefits, and the relation of law to cooperative structure and operations. Nourse believed that efficient cooperative performance depends on avoiding unnecessary duplication of effort, identifying member needs with association performance, achieving sufficient size to bargain effectively, and adjusting production to market requirements. Nourse also stressed that cooperatives should be an effective tool for equitable distribution of wealth. His emphases on limited capital holdings, restricted voting privileges, and democratic control brought into focus the importance he attached to the individual member.

To round out his philosophy regarding cooperatives, Nourse feared political expediency in Government. He believed that the inherent conflict of self-help versus Government assistance was unresolved. Nourse was a staunch foe of monopolies, and looked on cooperatives as a counterbalancing force that could help farmers to achieve equality in the marketplace.[6]

2-12. What Has Been The Role Of State Government In Farmer Cooperative Development?

Cooperatives' legislative support, development, organization, and operation involved many years of struggle, experimenting and interest. Farmers had active encouragement and assistance from farm organizations, land-grant universities, and others The farm organizations worked with cooperatives to enact Federal and State legislation.

Michigan passed what is believed the first law recognizing the cooperative method for buying and selling in 1865. However, the New York legislature had legalized cooperative mutual town fire insurance companies earlier in 1857.

State enactment of special cooperative statutes until 1920 moved slowly. However, between 1920 and 1930, numerous laws were passed and several passed in earlier years were amended and revised. All States now have cooperative statutes with a high degree of uniformity although varying in particulars. Statutes of Wisconsin, Nebraska, and Kentucky were used as patterns.

2-13. Government Role

Not all Federal laws that affect cooperatives grant a privilege or exemption. Some laws are general in nature yet have had a profound influence on cooperatives.

The Smith-Lever Act passed in 1914 created the Extension Service, now the Science and Education Administration, in the U.S. Department of Agriculture. Financed cooperatively by Federal, State, and county funds, the Extension Service placed personnel at State and local levels where farmers needed marketing and supply services. Extension personnel worked closely with farmers and farm organizations in educational organizations and operations for cooperatives.

---

[6] Martin A. Abrahamsen. Cooperative Business Enterprise. McGraw-Hill Book Co. 1976. pp. 79

2-14. Government Role

The Capper-Volstead Act of 1922 was discussed at length in lesson one as distinctive cooperative features were enumerated. The Capper-Volstead Act is a limited exemption from the antitrust laws granted to farmers in their marketing activities. It permits farmers to associate together in the marketing process where such cooperation might otherwise be an antitrust law violation, but it does not give unlimited exemption to the association once it is formed. It is the foundation for cooperatives marketing agricultural products to act as the farmers' agent.

2-15. Government Role

Cooperative research and education work begun by the U.S. Department of Agriculture in 1913 was strengthened and formalized in 1926 by the Cooperative Marketing Act. This act authorized research, technical assistance, and educational work be conducted with farmers and cooperatives in a division of cooperative marketing in the U.S. Department of Agriculture. Starting in 1933, this program was carried on by the Cooperative Research and Service Division of Farm Credit Administration. This division became Farmer Cooperative Service (FCS) in 1953 to more directly identify the work of the U.S. Department of Agriculture with cooperatives. Reorganization in the Department in December 1977 combined FCS with three other groups into a larger agency called Economics, Statistics, and Cooperatives Service. Three divisions—Cooperative Marketing and Purchasing, Cooperative Management, and Cooperative Development—conduct the cooperatives program in the larger agency.

The Cooperative Marketing Act permits exchange of various types of information among agricultural producers and their marketing associations. The full effect of this provision is not clear but it does appear to permit exchange of information among cooperatives that would otherwise be an antitrust law violation.

2-16. Government Role

The Farm Credit Act of 1933 recognized the credit needs of farmers' marketing, supply, and business service cooperatives. It provided for the establishment and initial capitalization of the 13 Banks for Cooperatives.

The Banks for Cooperatives provide dependable and economical lending services for cooperative facilities, operations and commodity loans. This enables cooperatives to establish a sounder financial basis through advice on business and financial practices.

Congress had earlier passed the Federal Farm Loan Act of 1916, establishing Federal Land Banks and Federal Land Bank Associations (then called National Farm Loan Associations) for long-term loans to farmers. Congress also passed the Agricultural Credit Act of 1923, providing establishment and capitalization of 12 Federal Intermediate Credit Banks to discount agricultural producers' notes given to other financing institutions.

The Farm Credit Act of 1933 also authorized establishment of local Production Credit Associations that could discount short-term farmers' notes with the Federal Intermediate Credit Banks.

The three banks—Federal Land Bank, Federal Intermediate Credit Bank, and Bank for Cooperatives—comprise the Farm Credit System. The Farm Credit Administration was established as an agency of Government by Executive Order of the President in 1933 to supervise the Farm Credit System. Later legislation, including the Farm Credit Act of 1971, has passed Congress, but the basic organization exists as we know it today.

2-17. Government Role

Passage of the Rural Electrification Act of 1936 is further evidence of Government support of cooperative endeavor.

Rural Electrification Administration (REA) was created by Executive Order of the President in May 1935 after a study and farm organization interest to "initiate, formulate, administer, and supervise a program of approved projects with respect to the generation, transmission, and distribution of electric energy in rural areas." In August 1935, the President issued the regulation establishing REA as a lending agency. Although the first year was a disappointment, Congress passed the Rural Electrification Act of 1936 reestablishing REA as a lending agency for 10 years.

Action came quickly as the agency encouraged and financially helped rural electric cooperatives provide electric service. In the face of opposition, electric lights began coming on all over America at reasonable costs.

The Rural Electrification Act was amended in 1949 to make the telephone loan program a responsibility of REA.

Helping improve the living conditions and business climate of rural areas through its rural electric and telephone program continues as a major component of REA's efforts.

2-18. What National Organizations Serve Farmers Cooperatives?

Cooperatives formed trade associations to create public understanding, promote their interest, and represent them in public and governmental affairs.

American Institute of Cooperation (AIC) was incorporated in 1925 as a National educational organization, a university without a campus. From the first AIC session in Philadelphia in 1925, AIC has brought together outstanding educators and agricultural leaders as instructors in an unequaled cooperative educational venture. As its founders envisioned, AIC makes special efforts to stimulate sound and constructive thought and educational activity on cooperative principles, practices, and operations as they relate to economic and public interest aspects of cooperatives.

AIC serves as a coordinator, a catalyst, and central focal point for education and information on cooperative educational programs, materials, ideas, and concepts available through cooperatives and educational institutions. It provides service to members through the National Institute on Cooperative Education and other conferences relating to cooperative personnel endeavors.

Members are primarily marketing, supply, farm credit, and rural electric cooperatives.

Cooperative League of the USA (CLUSA), established in 1916, is the oldest of national cooperative organizations.

Included in its diverse membership are national, regional, State, and local cooperative organizations, serving members in housing, health, credit, consumer goods, farm marketing and supply, mutual insurance, education, rural electrification, and travel.

In behalf of these members, the League has six major functions: (1) to advance public knowledge of cooperatives, (2) to improve the skills of cooperative directors and employees, (3) to encourage wise cooperative financing and operative policies, (4) to help cooperatives strengthen their member relations, (5) to seek Federal laws and administrative decisions consistent with cooperative aims and purposes, and (6) to promote development in the world's less-developed areas, both at home and abroad, through cooperatives.

The Cooperative League persists in efforts to encourage sound cooperative development in this country and overseas.

The League also produces and makes available a wide variety of cooperative educational and training materials, including basic how-to manuals.

National Council of Farmer Cooperatives (NCFC), organized in 1929, promotes growth and effectiveness of cooperatives, primarily through national legislative and regulatory assistance.

Members of the National Council include 108 operating cooperatives and 32 State councils of cooperatives.

These members range from small cooperatives marketing several million dollars worth of agricultural commodities annually to large cooperatives supplying more than $1 billion worth of farm inputs annually.

The National Federation of Grain Cooperatives merged with NCFC and now serves as the Grain Federation Division. This division promotes common business interest of regional grain cooperatives and their members through legislation, information on government regulations, and help in dealing with State and Federal agencies.

Total memberships increased from slightly more than 7 million in 1950-51, to a high 7.7 million in 1955-56, followed by a quite consistent decline to 5.9 million in 1976. This trend reflects the decline in the number of farms, although the drop in number of cooperatives has been less pronounced.

During this same period, marketing, farm supply, and related services cooperatives peaked in November at about 10,200 in 1951-52 and then declined to the present number of 7,535. Of this number 4,658 cooperatives primarily marketed farm products, 2,731 handled farm production supplies, and 146 conducted related services. Related services include trucking, storage, grinding, drying, and other similar services affecting the form, quality, or location of farm products and supplies handled for cooperatives.

The National Council and its Grain Federation Division represent more than 75 percent of the total business volume of agricultural cooperatives, and include a combined farmer membership of about 1.5 million.

The National Council has sought to create and maintain a favorable political and economic climate in which farmers and their cooperatives can do business.

The National Council's philosophy is keyed to the premise that agriculture, an essential industry, must remain healthy if the U.S. economy is to prosper and grow.

2-19. National Organizations

National Milk Producers Federation (NMPF) provides dairy farmers and their dairy marketing cooperatives with an effective voice in all branches of the Federal Government.

The Federation provides the organizational basis for the development of current policies and long-range objectives sought by dairy farmers and dairy farmer cooperatives. NMPF provides the mechanism to further these policies and objectives legislatively and administratively in the Federal Government.

Representing nearly all dairy marketing cooperatives in the Nation, the Federation serves as an effective voice in carrying information between member associations, Congress, and various Government agencies affecting the industry.

National Rural Electric Cooperative Association (NRECA) provides special services and a representative voice for legislative interests of member-owned electric systems. It is now the service organization for nearly 1,000 rural electric cooperatives and their statewide associations.

In addition to lobbying for legislation of interest to member systems as determined by resolutions adopted at the annual meetings, NRECA provides an insurance program, management and leadership training, counseling service, and research and information services. By formation of the Energy and Environmental Policy Division in the Department of Legislation and Communications in 1973, the association gave additional specialized support to member concerns. This division is responsible for all Government liaison and other association activities related to energy, environmental protection, bulk power supply, and related research.

Credit Union National Association, Inc., (CUNA) is a national nonprofit organization serving credit unions in the United States. CUNA is supported by dues paid by these credit unions.

Programs and services of CUNA are carried on and supported by State units or leagues offering direct assistance to more than 23,000 U.S. credit unions. Through the leagues, CUNA provides programs in financial and economic research, education and development, communications, finance and accounting support, public relations and advertising services, and governmental affairs.

Agricultural Cooperative Development International (ACDI) is chartered as a private nonprofit corporation. The board of directors is composed of experienced cooperative and farm leaders. In addition to establishing policy, it serves as liaison with all U.S. agricultural cooperatives and assists in recruiting capable cooperative technicians to staff long-term and short-term projects in client countries.

Member cooperatives contribute services and funds in support of the overseas cooperative development work of ACDI and other related programs. These include such sponsored efforts as Cooperative Fertilizers International (India Project), and the Volunteer Development Corps which furnishes short-term technicians on a volunteer basis for specialized services as requested by cooperatives in receiving countries. A major part of its activity is conducted under funded contracts with the U.S. Agency for International Development (AID).

2-20. State Cooperative Organizations

State cooperative organizations are trade associations of cooperatives with programs divided into three major areas—legislative, membership and education, and public relations. Organized in about 40 States, they are uniquely useful to cooperatives in providing communication, educational programs, and services individual cooperatives could not afford. Their programs range from simple to ambitious depending on available resources. In some States, council activities consist of a few educational efforts carried on by a part-time executive secretary who may be a State university staff member. In other States, councils have full-time staff members carrying all phases of programs.

The touch of education enclosed in the diamond is the logo of the Iowa Institute of Cooperation.

2-21. What Is The Extent Of Present Farmer Cooperative Activity In the United States?

The number of cooperative members and the number of their memberships in such organizations is often a confusing item in statistical presentations. It is estimated that at least five farmers out of six are members of one or more cooperatives. Also, a limited number of rural nonfarm people join farm supply cooperatives to obtain fuel oil, fertilizer, seed, and appliances. Indications are that, on the average, a cooperative member belongs to between two and three associations. Therefore, the combined number of memberships far exceeds the number of members.

2-22. What Is The Extent Of Present Farmer Cooperative Activity In The United States?

Combined annual net volume of all farmer cooperatives exceeded $40 billion in 1976. Grain, soybeans, soybean meal and oil; dairy products; fruits and vegetables; and livestock accounted for about 80 percent of the $30 billion of farm products marketed. In the farm supply group, three items--feed, petroleum products, and fertilizer accounted for about 70 percent of $9.4 billion of production supply business in 1976. The $0.9 billion farm services refers services related to the marketing of farm products and handling farm supplies.

2-23. What Is The Extent Of Present Farmer Cooperative Activity In The United States?

Farmers' use of cooperatives during the past quarter-century has increased steadily. From the farm, about 29 percent of farmers' products move to the next marketing level through cooperatives. This amount compares with 20 percent in 1950. Dairy products, grain and soybeans, fruits and vegetables, and livestock and livestock products account for more than 83 percent of all products marketed.

The net marketing business of $25.8 billion accounts for sales at the local or farm level. An additional $4 billion volume in marketing and processing increases net sales to $29.8 billion.

2-24. What Is The Extent Of Present Farmer Cooperative Activity In The United States?

Proportions of farm production supplies purchased through cooperatives has increased also—from 12 percent in 1950 to about 18 percent. The increase has come primarily from significantly larger volumes of fertilizer, pesticides, and petroleum products moving through cooperatives.

Cooperative sales for farm production use in 1976 amounted to more than $8 billion. An additional $1.4 billion sales went for nonfarm use for a total of $9.4 billion. Feed, fertilizer and lime, and petroleum products accounted for 73 percent of farm supply expenditures.

Suggested Assignments

—Make a study and report on cooperative development and legislation in your State.

—Make a study and report on the historical development, including changes in services, of the cooperative that is cooperating in your work experience assignment, or of a cooperative in the community and the State legislation affecting its development.

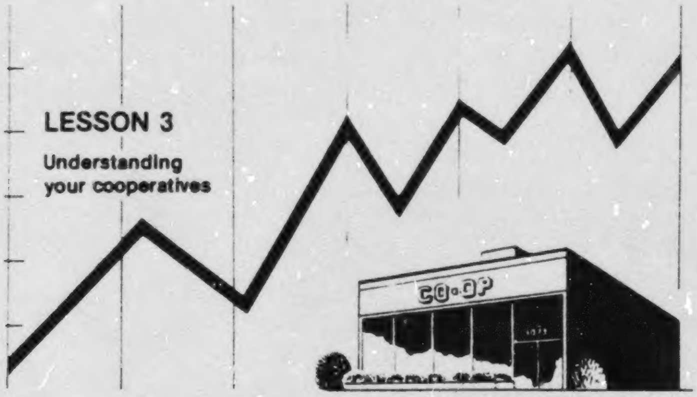
Selected References

Agricultural Cooperatives: Pioneer to Modern, Martin A. Abrahamsen, Section 2, Cooperative Information Report 1, 1977, 42 pp., Economics, Statistics, and Cooperatives Service, U.S. Department of Agriculture, Washington, D.C. 20250.

Cooperatives in Agribusiness, C.H. Kirkman, Jr., Cooperative Information Report 5, 1978, 59 pp., Economics, Statistics, and Cooperatives Service, U.S. Department of Agriculture, Washington, D.C. 20250.

Cooperative Business Enterprises, Martin A. Abrahamsen, 1976, 491 pp., McGraw-Hill, Inc.

ECONOMIC DEMOCRACY IN ACTION



Objective

— Determine the responsibility and relationship of key people in a cooperative.

3-1. How Do You Organize A Cooperative?

A few leaders with a common economic problem or need sooner or later begin to share ideas about possible solutions. They may need a market for their products, a satisfactory source of supplies, or some special service. They may decide a cooperative could solve it.

Usually, their next step is to approach a professional worker familiar with the cooperative organization and financing processes. With the assistance of this professional counsel, they assess the need for the cooperative and potential membership and volume. These facts and figures are presented to community leaders and potential members.

Assuming these preliminary figures look promising and people want the cooperative, an organizing committee needs to conduct an economic feasibility study that goes to greater depths in determining the likelihood of the proposed cooperative being successful and beneficial to members. This study may require expert help in economics, finance, credit, law, accounting, engineering, business operations, or other fields of endeavor. This feasibility report includes findings and recommendations on volume of business, operating costs, capital required, sources of supply or outlets, marketing methods, organization, financing, and many more concerns.

Assuming the feasibility report is favorable, the committee has several jobs to do, such as signing up the required number of members with adequate volume potential; obtaining member capital and arranging for capital loans; drafting the legal organization papers, including articles of incorporation, bylaws, and marketing agreements if a marketing cooperative; filing the articles of incorporation; and arranging for and conducting the organization meeting. When organized, all members, including new members, should understand the articles of incorporation, bylaws, marketing agreements, and other legal papers.

3-2. Who Are The Key People In A Cooperative?

Four groups of people are involved in operations of cooperatives. These groups have to make decisions at their respective levels to enable the cooperative to serve. These groups are:

—Members, as the owner-users;
—Directors, as the policymaking body;
—Manager and other key employees, as the operators; and
—Clerical and operating employees, as the workforce.

3-3. What Are The Responsibilities Of Members?

A cooperative has many owners called members. Members, sometimes called stockholders or shareholders, are the foundation on which the cooperative is built. Their similar needs are reasons the cooperative is organized and for its continued existence. Their increasing needs constantly shape the cooperative's future. Their support, through patronage and capital investment, keeps the cooperative financially healthy.

Investing initial capital is members' basic responsibility. Their share should be large enough to make them realize they have a financial stake in the business to want to protect this investment. It should also be a large enough share of capital needs to use as a credit base for borrowed capital.

As a general rule, members' invested capital is in proportion to members' anticipated use of the cooperative. Initial capital investment usually is in cash for which they are issued stock or membership certificates. As the cooperative serves members, proportionate capital investment may be based on volume or value of product, or capital retained from patronage refunds.

3-4. Member Responsibility

Members of a cooperative have a role in management that differs from that in ordinary business corporations. As owners they control the cooperative's primary function of performing needed services for their production operation.

Members, therefore, should be intimately and personally interested in affairs of the cooperative and should have a positive role in its management. They are responsible for the character of the cooperative's management. As members they stand to benefit directly from good management, and results of poor management fall directly on them. As owner-users-members, they have an interest and responsibility with their vote and financial support, to provide for overall management selection, training, and direction.

3-5. Member Responsibility

Experience has shown members do not always assume their responsibilities. Boards of directors and the manager and staff must provide the means and furnish opportunities for members to get the facts they need about their cooperative to carry out their responsibilities. Needed information may be presented through publications, letters, direct contacts or meetings.

The democratic nature of a cooperative entitles every member a vote. While voting is a right, it imposes a responsibility on the member to be informed and to vote intelligently. Thus members must be well informed and attend meetings to ask questions, discuss issues, express opinions, present ideas about ways to make the cooperative perform better, and vote.

Variation exists among cooperatives concerning the detail of proposed policy taken to members for their vote. Basic policy affecting members usually is determined by them. Examples include new marketing contracts, a new or different service offered, major changes in facilities, and capital structure change. Not to be overlooked is that members voted to start the cooperative and most States require a vote to disband it.

3-6. Member Responsibility

Members are responsible for promoting their cooperative association and its objectives. This means members should look on their association as their personal business. This requires that each member provide loyal support. The most important support a member can give is maximum or total patronage support.

For a cooperative to function successfully, it must have a substantial volume of business to obtain operating efficiencies and to generate sufficient cash flow. Members' capital can be further extended in a production or service cooperative by doing as much business for cash as possible and paying bills promptly when credit is extended. Members are responsible also for getting others to join and patronize their cooperative.

3-7. Member Responsibility

Business and community citizenship responsibility is not new for cooperative members. Cooperative members are customers of other community businesses. They fill various positions of community leadership. Participation of the cooperative and its leaders in business, community, and civic programs reflects the total cooperative image.

Being good business neighbors and assuming a real responsibility in building a better community can be most rewarding. What these business neighbors and the community think and say has an important effect on all cooperative members and employees in their respect and allegiance to the cooperative.

Establishing community involvement or relations solely for selfish purposes may backfire, but where member community interest is as great as self interest, both community and cooperative members may profit.

3-8. What Are Responsibilities Of Directors?

A cooperative is a democratically controlled form of business. But members cannot make directly all cooperative decisions. Democratic control is preserved by members electing directors to represent them in many affairs of management.

After a new cooperative is organized, members elect a board of directors from the membership. From then on, members elect a few (usually 7 to 9) of the leading members at the annual meeting to guide the cooperative.

The board of directors occupies a key position between members and paid management. It represents the members as users of cooperative's services, not as capital investors.

Cooperative directors must keep informed of services members need and endeavor to provide them efficiently. In contrast to stress on returns from capital investment, directors need to emphasize cooperative activities most beneficial to members' business, i.e. production supplies, marketing, and services for farmers or ranchers.

3-9. Director Responsibility

Directors discharge their duties as a board. They must deliberate, make decisions, and give instructions as a board, not as individuals.

The board must determine the rules, long range objectives, and plans governing the cooperative to ensure the association will succeed. As the members' representative, they must explore the economic feasibility of supplying anticipated future member needs through the cooperative. Long range plans are of major concern if the cooperative is to serve the real needs of producers as agricultural conditions change. While they may employ counsel, they cannot shift the responsibility to others.

When sufficient information is gathered and a determination is made, the board establishes the general policy to guide the cooperative operation.

3-10. Director Responsibility

While the board has responsibility to establish policy, many aspects of carrying it out can be delegated to the hired management. So a second way the board can meet its responsibility in directing business activities is to hire management. The term hired management is used to include the manager and other key personnel who are delegated management functions.

Employing a competent manager is one of the important responsibilities of the board. Success or failure of the cooperative may depend on how well the board handles this function. While hiring and delegating duties to the manager, the board must set ample clear-cut policies and delegate sufficient authority for the manager to perform these duties successfully.

3-11. Director Responsibility

Although the cooperative board of directors hires the manager and delegates details of operation, it is the board's responsibility to evaluate the organization's performance. It must insist on an adequate bookkeeping system to provide a basis to evaluate cooperative performance.

A complete and accurate bookkeeping system is absolutely essential for management to function properly. A balance sheet and operating statement should be prepared monthly to draw attention to assets and debits subject to rapid change and provide a month-to-month comparison of key items for directors to see what is happening in operations. Operating statements related to operating budget greatly increase the value of each.

Farmer cooperatives need two kinds of special records to perform unique cooperative functions—those to achieve service at cost for members and those associated with member patron financing.

The board must insist on regular external audits of these accounts to varify business records. This independent auditor, employed by the board, presents the report directly to the board to provide it a first hand independent evaluation. Careful study of an audit report reveals the extent the manager has followed board financial policies and approved budget. It also can indicate whether the cooperative is meeting its basic objectives in service to members at reasonable cost.

3-12. Director Responsibility

Members delegate to their directors authority for checking on the cooperative performance. Directors thus have a responsibility to take active and energetic steps to keep the membership fully informed on association activities and problems.

For directors to report to members, they must understand the key elements of cooperative success and be closely acquainted with the current and forecast progress of the business concerning its various operations. Knowledge of the cooperative's purpose, history, and place in the market are helpful in assessing and reporting to members. The annual audit report showing sales volume of product or services, current value of assets, and the liabilities are helpful in making the report. Directors should be aware of obsolescence of physical plants and keep members aware of their replacement needs. Members are always interested in net margins, patronage refunds, and the ability of employees to provide the products, service, or marketing they desire. Future plans for expanded or new services must be reported to members. While often overlooked, it is important that negative, as well as positive, aspects of cooperative operations be reported to members, so they have an accurate perspective in exercising their ownership responsibilities.

3-13. Director Responsibility

Directors are vested by law with the duties and responsibilities of conducting the affairs of the corporation.

State and Federal statutes governing cooperatives dictate explicit managerial responsibilities for directors. Directors are charged with all corporate powers of an association other than those specified for members.

Although the board of directors must function as a group, each director must assume responsibility and liability for the cooperative's operations and actions—bonds, agreements, customer services, and many more. Each is accountable for board decisions irrespective of presence or absence at a board meeting when the decision is made.

3-14. What Are The Manager's Responsibilities?

The manager supervises and coordinates the cooperative business activities by managing people, the human resources, and managing the physical resources.

In a developing or small cooperative, the manager, employed by the board of directors, may attempt to do everything. In larger cooperatives, the manager has a major staffing responsibility. In these larger cooperatives, key staff such as major officers or heads of departments may be selected with approval of the board because of their management functions.

Heads of departments need to work with the manager in staffing positions in their respective departments. This enables authority for staffing and responsibility for work accomplished to be coordinated.

It is important that the manager or the key staff provide employees with a job description. This provides opportunity for review of the job and relate it to the total operation. Often it is possible to jointly develop a set of objectives and goals that enables greater coordination of the cooperative's program to meet changing demand and opportunities for service to members.

3-15. Manager Responsibility

The manager sets a basis for supervising and coordinating human and physical resources by developing goals and plans to reach objectives. Through goals and short-range plans, the manager takes steps to carry out policy established by the board. These plans, including establishing budgets, serve as a guide for the financial business activities as well as services performed.

Establishing goals and plans offers opportunity for managers with imagination and desire to serve members to include their personal objectives within policy and anticipate changing member needs. These goals also provide a means of informing employees what is expected of them. Employees, accordingly, can plan programs delegated to them to meet the budgets and other goals established.

3-16. Manager Responsibility

Execution of policies established by the board of directors is the responsibility of the manager. This involves all aspects of the cooperative's day-to-day performance. The manager thus has responsibility for directing and controlling the day-to-day business activities, such as use of personnel, capital, facilities, and equipment. He is also responsible for commodities marketed, materials handled, and services provided.

As in any corporation, the manager must operate the association on a sound business basis by developing an effective business structure. In effect this requires using operating and financial budgets, and sound purchasing, marketing, service, and pricing practices. While maintaining an adequate accounting and record system in any business is important, added responsibility exists because of needed member records for determining refunds if any, and tax treatment.

3-17. Manager Responsibility

The manager has responsibility in the day-to-day operation to make best use of personnel. This requires a continuing program for appraising each job and evaluating the performance of the person filling it. An evaluation program:

- Determines how well the staff assumes and performs assigned responsibility;
- Encourages the staff to improve skills or ability; and
- Ensures best use of the staff's talents.

Performance evaluation assumes the staff can adjust to job and program requirements and have capacity for improvement. An evaluation program can encourage employees toward self-improvement when they know opportunity exists for advancement.

While employee development is a manager responsibility, the board must provide evaluation policy guidelines.

3-18. Manager Responsibility

Hired management's responsibility is derived from that responsibility entrusted by members to the board of directors. Because the manager is working with members' money, he has not only the duty to operate the cooperative efficiently but also to report regularly to directors and members.

Reports such as the operating statement are used to present accurate information at the board of directors meeting to help the board reach knowledgeable decisions. In larger cooperatives, the manager invites key staff, such as heads of departments, to board meetings so they may report on their operations and serve as resource people.

Less detailed reports are circulated on a regular basis to members. These reports, often on a monthly basis, contain items of interest to members and may include market situation, product movement, inventory, and many other kinds of reports of member concern. These reports are often contained in newsletters, newspapers, or magazines.

Annual meetings are held as provided in the bylaws. The purpose of the annual meeting is to review the program and the business of the cooperative for the past year, elect officers, and plan and decide future activities.

Members are entitled to know all the pertinent facts concerning their organization and to receive an up-to-date progress report. Combined efforts of the manager and directors in properly presenting and intelligently discussing annual reports offer a basis of mutual understanding between management and members. After reports by the employed management staff and directors, members have the opportunity to ask questions and to make suggestions.

3-19. What Are Employees' Responsibilities?

Employees working for cooperatives need to know what cooperatives are and how they compare with other methods of doing business. Understanding cooperative purposes, objectives, operations, and their role in the community is important for employees. They are frequently called on to answer questions about their employing cooperative and cooperatives in general. Well informed employees can help improve cooperative image and understanding.

Management can inform employees about the cooperative through staff meetings, training programs, and printed materials. Many employees may be hired right out of school. Most students receive little or no cooperative education. Some cooperatives have programs through youth organizations. Some land grant universities offer courses in cooperatives. This means that while employees are responsible for understanding the purpose and objectives of cooperatives, management must pay particular attention to developing employee education and training programs.

3-20. Employee Responsibility

In many cooperatives, like other business firms, the largest operating expense is for personnel. In addition to salaries and wages paid, these costs include interviewing, hiring, training, and fringe benefits. Training and developing employees, both formal and informal, must be the result of planned conscious efforts. It is a continuing process and may include on-the-job and programmed outside training. This requires sizable investment in employees to help them become productive.

Cooperatives, like other business firms, expect fully performed duties for the invested training, compensation, and benefits provided. Cooperative managers know they must pay competitive salaries and provide comparable benefits if they expect to recruit and hold qualified employees.

While the cooperative has responsibility for recruiting and providing training situations, the employee is responsible for using these opportunities to better prepare to fully perform duties of service to members.

3-21. Employee Responsibility

In a small local cooperative, the manager maintains good relations between the cooperative organization and members. The personal contacts keep the members informed of their cooperative's activities. Immediate feedback from members is encouraged to keep the manager informed of problems, needs, and evaluation of services.

Situations may be quite different in larger cooperatives. Personnel hired by regional cooperatives may have sole responsibility for building cooperative image as they serve members. The only cooperative employees that members encounter from annual meeting to annual meeting may be the warehouseman loading supplies in the patron's truck, fieldman, truck driver, telephone operator, credit officer, cashier, or billing officer.

This means the clerical and operating employees, as representatives of the cooperative, have responsibility to understand the relationship to member-owner-patrons. They must realize the members own the cooperative, not the employee or management, and that services provided are for concerned members. Application of common sense and reason to the cooperative policy is expected by members.

Members expect employees to listen. When members complain, some adjustments may be made at the sight with a few words of reassurance, an extra step to provide satisfaction, or to see that equipment is properly performing.

Complaints concerning management should be promptly delivered to management after endeavoring to obtain adequate and correct information.

3-22. Employee Responsibility

Employees help build the cooperative's image as they serve members and the community—both at the cooperative's premises and away from them. Employees are responsible for keeping the premises clean and attractive so other businesses on the main street desire them as business neighbors. They need to learn about cooperative principles and practices to respond readily with accurate information when people ask.

They are proud that members through their cooperative offer employment to highly qualified and experienced people for the many technical and complex tasks involved in marketing, processing, purchasing, and transacting other business. As the cooperative grows, they know additional employees will be needed, new facilities will be built, and more community income will be created. This added income expands the business community, improves and builds homes, and supports and maintains community affairs and projects.

Employees, within limits of cooperative policy and like their manager, can be community boosters by taking part in church, school, or community affairs. Their efforts can positively affect the cooperative image held by members, the general public, and other businesses.

3-23. Economic Democracy in Action Requires Everybody Working Together

A cooperative is economic democracy in action. It requires everybody working together—members, directors, manager and key employees, and clerical and operating employees—to have a successful cooperative. All these persons pulling their share of the load helps the cooperative business offer opportunity for members and their communities to adjust to changing economic and social conditions.

Suggested Assignments

-- Make a study and report on the four groups of people—members, directors, manager and key employees, and clerical and other operating employees—involved in the cooperative cooperating in your work experience, or in a cooperative in the community.

—Identify opportunities for employment in cooperatives in the community and procedures for applying for employment.

—Identify opportunities for member responsibilities in a cooperative where you, your parents, neighbor, or friends hold membership and determine how these responsibilities can be assumed.

Selected References

Cooperatives in Agribusiness, C.H. Kirkman, Jr., Cooperative Information Report 5, 1978, 59 pp., Economics, Statistics, and Cooperatives Service, U.S. Department of Agriculture, Washington D.C. 20250.

Cooperative Business Enterprises, Martin A. Abrahamsen, 1976, 491 pp., McGraw-Hill, Inc.

PRINCIPLES UNDERLYING COOPERATIVE FINANCING AND TAXATION

LESSON 4

Understanding your cooperatives

STOCK
FORM 1040

Objectives

— Understanding cooperative business firms need capital and how cooperative capital is attained.

— Understanding cooperatives pay taxes required by law.

4-1. Who Finances A Business?

Business needs capital for two main purposes—to acquire fixed assets and for working capital.

Three groups of people finance the business through different processes:

— Owners finance a business as investors. This capital should be sufficient to obtain fixed assets that cannot be financed on long terms at reasonable interest rates. Owners may also provide some working capital.

— Creditors as lenders finance a business. This borrowed money may come from one of many places—banks, insurance brokers, and other sources through issuance of negotiable paper secured by the owners investment.

— Customers as purchasers finance a business. The owners retain profits for reinvestment in the business from year to year.

4-2. How Do Those Who Finance The Business Benefit?

The three groups of people who finance a business do so for different reasons.

— Owners finance a business expecting a return on investment through service to other people.

— Creditors are willing to invest or lend money to the business in return for interest the owners are willing to pay.

— Customers are willing to pay owners of a business a profit to get the goods and services desired.

4-3. How Does Cooperative Financing Differ?

Cooperatives, like other business operations, need capital to get started and to provide owner-member services. Members finance their cooperatively owned business by using all the usual methods employed by other business corporations plus a few distinctive to cooperatives.

Members organize purchasing and service cooperatives to obtain goods and services for themselves. In essence, the owners are the customers or patrons. As owners, they provide the capital to start the cooperative expecting to get services in return. As patrons, they must pay for the use of the cooperative as it obtains the supplies and services for them.

Although capital needs of purchasing and service cooperatives vary according to volume of business, seasonality, type and amount of business conducted as it does for other businesses, cooperatives' equity financing sources are more limited. Outside capital sources are limited because interest payments and stock dividends paid by cooperatives are limited by law.

Returns on member capital are limited to 8 percent per annum by many State statutes and the Capper-Volstead Act. Banks for Cooperatives require that dividends on a cooperative's stock or membership capital be limited to 10 percent a year for cooperatives to be eligible for loans if voting is on other than one-member, one vote basis.

Outside capital investment is limited also because of the noncumulative stock value, and the absence of speculative trading.

The conclusion is that member-owners of purchasing and service cooperatives bear substantially greater burden for providing capital for their cooperative business than do owners of other businesses.

4-4. How Does Cooperative Financing Differ?

Marketing cooperative financing, like purchasing and service cooperatives financing, also differs from other business financing.

Members establish their cooperative to obtain a market for products they produce. Again, the owners are the users but in a different sense. As owners, they provide the capital to start the cooperative to obtain the marketing services needed. As marketing patrons, they must pay for the use of the cooperative as it assembles, processes and sells their raw and processed products.

As in purchasing or service cooperatives, marketing cooperative equity financing sources are limited because interest payments and stock dividends paid by cooperatives are limited by law.

However, the people who purchase the farmer-member products as customers are consumers. They are willing to pay the cooperative for the goods and services they offer. As in any business, these consumer customers indirectly pay the member-owners of the cooperative business a profit to get the goods and services desired. Member-owners may decide to reinvest some of this profit in the cooperative from year to year.

The limited return on member capital, discourages investment in cooperative marketing businesses. Investment in cooperative business stock is further discouraged by its noncumulative value that results in no speculative stock trading.

The conclusion is that member-owners of marketing cooperatives, as in purchasing and service cooperatives, bear substantially greater burden for providing capital than do owners of other businesses.

4-5. What Capital Is Needed?

Cooperatives like any business need two kinds of capital—fixed capital and operating capital.

Fixed capital is money to buy such things as land, buildings, and equipment for buildings and for transportation.

Operating capital is the money required to keep the business going or operating. These requirements include paying employees, buying operating supplies such as packing cartons and office supplies, paying for electricity or other utilities, advancing members money on products marketed for them, building adequate inventories, providing services and many more items.

Total capital needed by a cooperative depends on such factors as volume of business, type of service it provides, kind of physical facilties needed, nature of competition it faces, seasonality of commodities handled, and degree of risk it takes in the day-to-day conduct of its business. Whatever the total amount of capital, it normally is related to the number of members and volume of business.

4-6. How Do Members Provide Equity Capital?

Equity or risk capital provides the necessary elements of ownership and control that any business must have. It serves as a buffer for creditors to absorb operating losses and shrinkage in assets. In a cooperative the members must provide the equity capital.

Common stock is generally used by cooperatives organized with capital stock to indicate membership or voting stock. Some nonstock cooperatives issue membership certificates to qualified farmers to denote membership or voting rights. Regardless of the type of certificate used, capital raised from sale of voting stock is of nominal importance. To obtain additional equity capital many cooperatives issue one or more classes of nonvoting capital stock.

Members and patrons provide their cooperative with equity capital in four ways:

— Purchasing capital stock or other securities.

— Investing a portion of the net margins.

— Contributing capital through deductions from sales proceeds in the form of per-unit capital retains.

— Contributing base capital in proportion to historical use of facilities and services furnished either directly or through the other three methods.

The methods used in obtaining equity capital vary by type of cooperative operation. While members in most cooperatives purchase capital stock or other type securities, they usually use at least one other method.

4-7. How Do Members Provide Continuing Equity Capital In Supply And Service Cooperatives?

Members in supply and service cooperatives invest a portion of their patronage allocations from net margins from purchases in addition to purchased stock or securities as equity capital. The patronage allocations invested are net margins realized in cooperative operations in obtaining the supplies for members or in providing services to members. These patronage refunds allocated as equity capital are often returned to the member patrons as deferred payments on a revolving fund basis. Repayment goes first to member patrons whose contributions are the oldest in the revolving fund.

The revolving fund plan allows members to provide equity capital in their cooperative in proportion to the amount of business they do. It provides for current patron investment and an orderly process of withdrawing the members' investment without impairing the total cooperative capital structure. It also provides the cooperative business flexibility to meet changing conditions that influence financial needs. Successful operation of a revolving capital equity plan requires member understanding of their financing obligations.

4-8. How Do Members Provide Continuing Equity Capital In Marketing Cooperatives?

Retained net margins are important sources of capital in larger marketing cooperatives, especially multipurpose and diversified marketing organizations. As in supply cooperatives, members invest a portion of their patronage allocation that came from net earnings. Members also purchase capital stock and other equities.

Members in marketing cooperatives invest substantial amounts of per-unit retains to purchased stock or securities as equity capital. Per-unit capital retains are those investments made by member patrons in compliance with a bylaw provision or membership agreement. The agreement authorized the cooperative to make a specified deduction for equity capital from advances to member-patrons based on physical unit marketed or processed and marketed (hundredweight, bushels, cases, cartons, dozens, etc.) or a percent of the sales return to member patrons.

Acquiring equity capital varies widely for commodity groups in marketing cooperatives. For example, grain marketing cooperatives acquire about one percent of their equity capital by per-unit capital retains from sales proceeds. Fruit and vegetable cooperatives in contrast may acquire as high as $2 out of $3 of equity capital by this method.

Successful per-unit retain financing on a revolving basis in marketing cooperatives requires member education and understanding of their financing obligations.

4-9. How Do Members Provide Continuing Equity Capital On A Permanent, Non-Revolving Basis?

Members of some cooperatives, more often marketing cooperatives, provide continuing equity capital on a permanent, nonrevolving basis to operate the business. This modification of the traditional revolving fund plan is called base capital financing.

Member-patrons, usually by bylaw provision, make capital contributions in proportion to their respective use of facilities and services. The total amount of cooperative capital required is determined from time to time by the board of directors. The proportionate share of such amount of capital provided by each member-patron is based on the volume or value of products marketed through the cooperative during a representative period of 5 or 10 years.

When the capital share of a member-patron for any fiscal year exceeds the capital credits attributed to him at the beginning of the year, the amount of the excess is assessed to the member-patrons. This amount may be withheld or retained from the proceeds of sales of member products, patronage dividends, or any other amount due the member-patron. If the member's share for a given year is less than the capital credits attributed to him at the beginning of the year, the difference may be refunded at the time and in the manner determined by the board of directors. The cooperative must treat all members alike.

Cooperatives using base capital financing keep their membership up to date. Those who do not use the cooperative are rotated out of the cooperative thus keeping membership current. Those who use the services most have the greatest capital investment.

4-10. Where Does A Cooperative Get Borrowed Capital?

Cooperatives need more capital than expedient for most members to provide. This capital must be borrowed using member equity capital as collateral. Members' share of total capital must be large enough to invite credit sources for additional capital when needed. These loans may be long-term credit for facilities; intermediate-term credit for operating capital, or short-term commodity loans for marketing cooperatives.

Cooperatives use the usual sources of credit available to all business organizations plus some special cooperative sources.

— Members may lend additional capital through purchase of securities for which they are paid limited interest or dividend. Members may borrow capital against personal securities through Production Credit Associations or Federal Land Bank Associations for their initial investment to get the cooperative started or to finance their commodities until marketed through their cooperative.

— Nonmembers such as other cooperatives; marketing and supply companies; individuals, firms, and organizations interested in the cooperative's limited interest, or in its welfare and success in the community are sources of borrowed capital.

— Banks for Cooperatives, organized under the Farm Credit Act of 1933, provide a permanent, specialized credit and business service at cost on a constructive basis for farmer cooperatives.

A farmer cooperative becomes a member of a Bank for Cooperatives by borrowing from it. When it does, the association invests in the capital stock of the bank on a continuing basis in proportion to the interest it pays on its loans.

To be eligible to borrow from a Bank for Cooperatives, a cooperative must be an association in which farmers act together in performing one or more of the following:

1. Processing, preparing for market, handling, or marketing farm products.
2. Purchasing, testing, grading, processing, distributing, or furnishing farm supplies.
3. Furnishing farm business services.

It is also necessary that an association be operated for the mutual benefit of its members and that it does at least as much business with members as with nonmembers.

Along with making loans, the Banks for Cooperatives offer counseling services to cooperatives. The Banks have experienced personnel available for this added assistance.

— Commercial banks are a source of borrowed capital as for any type business.

— Various other lending institutions such as insurance companies, pension funds, and others may also lend to a cooperative.

4-11. What Are Some Special Sources Of Borrowed Capital?

— Rural Electrification Administration (REA) in the U.S. Department of Agriculture is a recognized specialized source of loan funds. REA loans are made: (1) To provide electric service in rural areas through construction of power lines and related facilities; and (2) to finance the improvement and extension of telephone lines in rural areas.

REA guarantees loans to facilitate obtaining financing for large-scale electric and telephone facilities from non-REA sources. Guarantees are considered if such loans could have been made by REA and may be made concurrently with an REA loan.

— Rural electric cooperatives also have their own self help institution, the National Rural Utilities Cooperative Finance Corporation (CFC) as a supplementary financing source. Under a form of common mortgage agreement, REA gives loans made by CFC and other nongovernmental lenders equal status with those of REA on a prorata basis.

REA also offers its borrowers technical assistance in engineering, accounting, and management development.

— Rural telephone cooperatives operate under the same general cooperative principles as rural electric cooperatives. They are located in 31 States and obtain funds from REA and from the Rural Telephone Bank—an agency of the U.S. Department of Agriculture established in 1971 to provide supplemental financing for telephone systems. Bank loans are being made for the same purposes as loans made by REA but bear interest at the rate consistent with the Bank's cost of money.

Other sources of Government credit to cooperative and other business organizations change as programs change. Up-to-date Federal loan program assistance available is listed in a Catalogue of Federal Domestic Assistance compiled for the Executive Office of the President, Office of Management and Budget. It is available through Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 or may be found in libraries under Library of Congress No. 74-600118.

4-12. How Do Tax Regulations Apply To Cooperatives?

Contrary to beliefs, confusion, and misunderstanding of many people, cooperatives are taxed. Cooperatives pay all taxes required by law to all levels of Government. This requires extensive bookkeeping and requires capital to pay these taxes. Taxes co-ops pay include:

Sales - collected from everyone unless exempt as food and drugs in some States.

Payroll - employer's share of social security taxes.

Franchise and license - for the right to conduct business in a State or locality.

Gasoline - for use in trucks and automobiles for business purposes.

Real estate - real property, land, and buildings.

Personal property - office furniture, inventory, equipment, and machinery.

Excise - special tax on manufacture or sale of certain products or items—tires, tobacco, and others.

State income - a tax on the taxable income of corporations, including cooperative corporations, except for some specific exemptions or exclusions as assessed in most States.

Federal income - a tax on the taxable income of corporations, including cooperative corporations except for some specific exemptions or exclusions.

4-13. What Is The Principle Of Federal Tax Law For Any Firm Operating On A Cooperative Basis?

Today's Federal tax law preserves the right of any business whether chartered as a cooperative or not to establish bylaws to operate and act as a cooperative. These tax laws preserve the principle of a single tax on net income produced through cooperative-oriented business activities. The federal income tax must be paid on net margins by either the cooperative or the member. If the net margin goes to the member as a patronage refund, then the refund must be listed as income on the member's income tax form for tax purposes.

Businesses operating on a cooperative basis must keep extensive records and adhere to strict requirements as to the form in which they handle capital retains and distribute patronage refunds.

4-14. What Is Meant By "Operating On A Cooperative Basis"?

There are two major requirements for operating on a cooperative basis.

First, more than 50 percent of the association's business transactions must be conducted with members. In a farmer cooperative, this means the dollar volume of products marketed, supplies purchased, and services provided for members must exceed 50 percent of the total dollar volume of products sold, supplies purchased, and services provided for nonmembers.

Second, the business must refund net margins in proportion to patronage. The 1962 law defines patronage dividends as refunds that are computed on the basis of the quantity or value of business done with patrons, made pursuant to a contractual obligation that was in effect before any transaction took place with patrons, and which were determined by reference to the net margins generated by the cooperative from business with patrons.

4-15. Where Is Information Describing Cooperative Tax Treatment?

Cooperative tax treatment information is described in Section 521 and Subchapter T, IRS Code. It applies to all farmer cooperatives and certain other corporations operating on a cooperative basis.

In the process of conforming with the law, a number of alternatives are provided that cooperatives must evaluate and on which management decisions must be made.

A major alternative a farmer cooperative faces is whether to operate in compliance with the requirements of Section 521 of the Internal Revenue Act of 1954 as a so-called "income tax exempt" association; or whether to operate as a nonexempt organization by not meeting the requirements of Section 521.

4-16. What Requirements Must Business Fulfill To Have "Cooperative" Tax Status?

The law prescribes precise rules on the circumstances under which business corporations may use patronage refunds to reduce their gross income for tax purposes.

Records are generally used by management to keep them informed of conditions in the business. However, for a business to attain cooperative tax status, transactions with each member-patron must be recorded and transferred to the patronage volume ledger. The partonage volume records are needed to allocate and distribute the net margins at the end of the year. The records are useful in fulfilling requirements for "cooperative" tax status because the IRS code requires that cooperatives maintain permanent patronage and equity interest records for each member.

The net margin allocated on a patronage basis must also meet IRS code requirements. At least 20 percent of the patronage refund must be paid in cash with the remaining portion in property of a kind on which a current value can be placed. The statutes call this "qualified written notices of allocation," or in the case of marketing cooperative capital retains, "qualified per-unit retain certificates." The statutes also require the refund must be paid within 8 ½ months after the close of the cooperative's fiscal year.

If the business does not comply with these rules, it does not attain cooperative tax status. It cannot exclude patronage refunds from taxable income and thus pays the tax on all net margins at the corporate rate.

4-17. What Requirements Can A Farmer Cooperative Fulfill To Gain "Limited" Tax Exemption?

To obtain limited tax exemption or so-called "income tax exempt" status, farmer cooperatives must file for a letter of exemption with the Internal Revenue Service. To obtain this letter of exemption, additional requirements must be fulfilled by the cooperative.

The cooperative must do at least half of its business with members. Cooperatives must not purchase more than 15 percent of their supplies for nonmembers who are not farmers. This is sometimes a difficult requirement to meet where a cooperative sells fertilizer that nonfarmers use.

Another important requirement is that members and nonmember users must be treated alike. This is why some cooperatives may pay patronage refunds to urban or suburban resident purchasers.

4-18. When A Farmer Cooperative Qualifies For Exemption, What Other Tax Deductions Are Permitted?

Farmer cooperatives qualifying for so-called income "tax exempt status" are permitted certain other tax deductions.

Qualifying organizations are allowed to deduct from gross income amounts of nonpatronage income paid out on a patronage basis, if distributed within 8½ months after the end of the business year in which it was derived. This deduction includes all nonpatronage income such as business with the United States, rents received on property, and interest received from deposits or investments provided it is paid out on a patronage basis by the specified time.

In computing the taxable income, qualifying organizations are allowed to deduct from gross income amounts paid as dividends during the year on its capital stock. This is construed to include any form of return on all genuine capital interests.

4-19. What Reporting Procedures Must A Cooperative And Its Members Follow Concerning The Tax Treatment Of Patronage Refunds?

Farmer cooperative corporations, the same as other corporations, must file an income tax statement. Cooperatives deduct from their taxable income the amount of patronage refund paid or allocated that qualifies under the Internal Revenue Code. The so-called "income tax exempt" farmer cooperative include the amounts paid out as dividends on capital stock and nonpatronage income as deductions which nonexempt cooperatives do not.

Patrons receiving the patronage refund report the entire refund as ordinary income. This means the cash refund and the noncash certificates must be listed as income to the member on their income tax form.

4-20. Summary

Member-owners of a cooperative corporation must bear a greater burden for financing the association than do owners of other corporate business. The member-owners are also the patrons of marketing, purchasing, and service cooperatives and thus assume a dual role of responsibility.

Farmer cooperatives must meet special Internal Revenue Code requirements to gain limited tax exemption or so-called "income tax exempt" status and treatment. These requirements limit nonmember, nonproducer business to not more than 15 percent and provide that nonmembers and members be treated alike.

The Internal Revenue Service Code provides farmer cooperatives alternate methods of handling net margins. This includes the choice of whether to qualify for the so-called "income tax exempt" status.

The Internal Revenue Service code sets down precise rules on circumstances under which farmer cooperatives, nonexempt and exempt, may use patronage refunds to reduce their gross income for tax purposes. If the cooperative does not comply with the rules, it cannot exclude patronage refunds from taxable income and is subject to taxation on them at the corporate rate. Even though the cooperative may comply with the rules, either the cooperative must assume the tax liability of the patronage refund or the member-patron must comply by reporting the entire refund as ordinary income.

Contrary to beliefs many people seem to hold, cooperatives pay all other taxes as required by law on the same basis as do other business corporations.

Suggested Assignments

— Determine how your district Banks for Cooperatives work with members and cooperatives in your community on financial matters.

— Make a study and report on the methods used in financing the cooperative cooperating in your work experience, or a cooperative in your community.

— Make a study and report on taxes and licenses paid by the cooperative cooperating in your work experience, or by a cooperative in your community.

Selected References

Cooperatives in Agribusiness, C.H. Kirkman, Jr., Cooperative Information Report 5, 1978, 59 pp., Economics, Statistics, and Cooperatives Service, U.S. Department of Agriculture, Washington D.C. 20250.

What Are Patronage Refunds, David Volkin, Cooperative Information Report 9, 1978, 7 pp., Economics, Statistics, and Cooperatives Service, U.S. Department of Agriculture, Washington, D.C. 20250.

Cooperative Business Enterprises, Martin A. Abrahamsen, 1976, 491 pp., McGraw-Hill, Inc.

Legal Phases of Farmer Cooperatives, Part II, Federal Income Taxes, Morrison Neely, Information 100-2, 1976, 193 pp., Economics, Statistics, and Cooperatives Service, U.S. Department of Agriculture, Washington, D.C. 20250.

Handling Net Margins Under Federal Tax Laws, David Volkin and J. Warren Mather, 1976, 6 pp., Economics, Statistics,and Cooperatives Service, U.S. Department of Agriculture, Washington, D.C. 20250.

Film

"Capper-Volstead-A Legislative Foundation for Agricultural Cooperatives," 1974, 10 minute film-o-graph, 16 mm, sound, color, American Institute of Cooperation. Available through regional cooperatives, Farm Credit Banks, or State cooperative councils.

Other Publications

Cooperative Brands and Processed Foods. Clement Ward and David Morrissy. Information 110. 1977. 47 pp.

Cooperative Special Service. John M. Bailey. Information 105. 1977. 28 pp.

Mr. Chairman. C.H. Kirkman, Jr., Cooperative Information Report 8. Revised 1978. 20 pp.

Manager Holds Important Key To Co-op Success. C.H. Kirkman, Jr., Cooperative Information Report 16. Revised 1978. 11 pp. (Also in Spanish).

Advising People About Cooperatives. C.H. Kirkman, Jr., and Paul O. Mohn. Program Aid 1147. 1976. 20 pp.

Sample Legal Documents, Part I, Legal Phases of Farmer Cooperatives. Morrison Neely. Information 100. 1976. 42 pp.

Antitrust Laws, Part III, Legal Phases of Farmer Cooperatives. Morrison Neely. Information 100. 1976. 56 pp.

Employees Help Co-ops Serve. C.H. Kirkman, Jr., Cooperative Information Report 17. Revised 1978. 15 pp.

Capper-Volstead Impact on Cooperative Structure. Joseph G. Knapp. Information 97. 1975. 48 pp.

Using Co-op Members' Money. C.H. Kirkman, Jr., Cooperative Information Report 13. Revised 1978. 15 pp.

Members Make Co-ops Go. C.H. Kirkman, Jr., Cooperative Information Report 12. Revised 1978. 11 pp. (Also in Spanish).

What Are Cooperatives? C. H. Kirkman, Jr., Cooperative Information Report 11. Revised 1978. 9 pp. (Also in Spanish).

Understanding Capper-Volstead. David Volkin. Reprint 392. 1974. 8 pp.

Guidelines Co-op Employees Need. C.H. Kirkman, Jr., Cooperative Information Report-18. 1978. 34 pp.

Improving Management of Farmer Cooperatives. Milton L. Manual. General Report 120. Revised 1973. 47 pp.

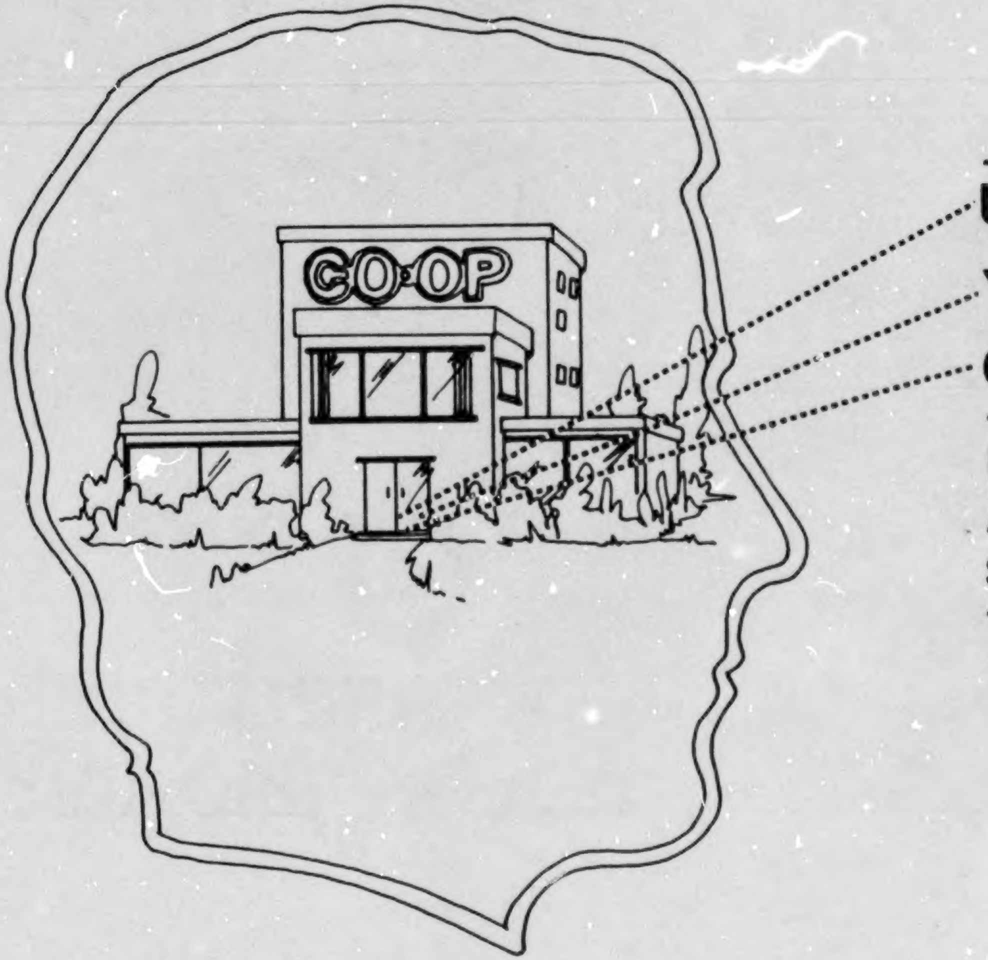
Opportunities in the Co-op Business World-A Leader's Program for Youth. C.H. Kirkman, Jr.,Information 80. Revised 1978. 52 pp.

Cooperative-Distinctive Business Corporations. C.H. Kirkman, Jr., Cooperative Information Report 3. 1978. 24 pp.

How to Start a Cooperative. Irwin W. Rust. Education Circular 18. Revised 1972. 18 pp.

Measuring Co-op Directors. C.H. Kirkman, Jr.,Cooperative Information Report 15. Revised 1978. 12 pp. (Also in Spanish).

For copies, write Economics, Statistics, and Cooperatives Service, U. S. Department of Agriculture, Washington, D.C. 20250.



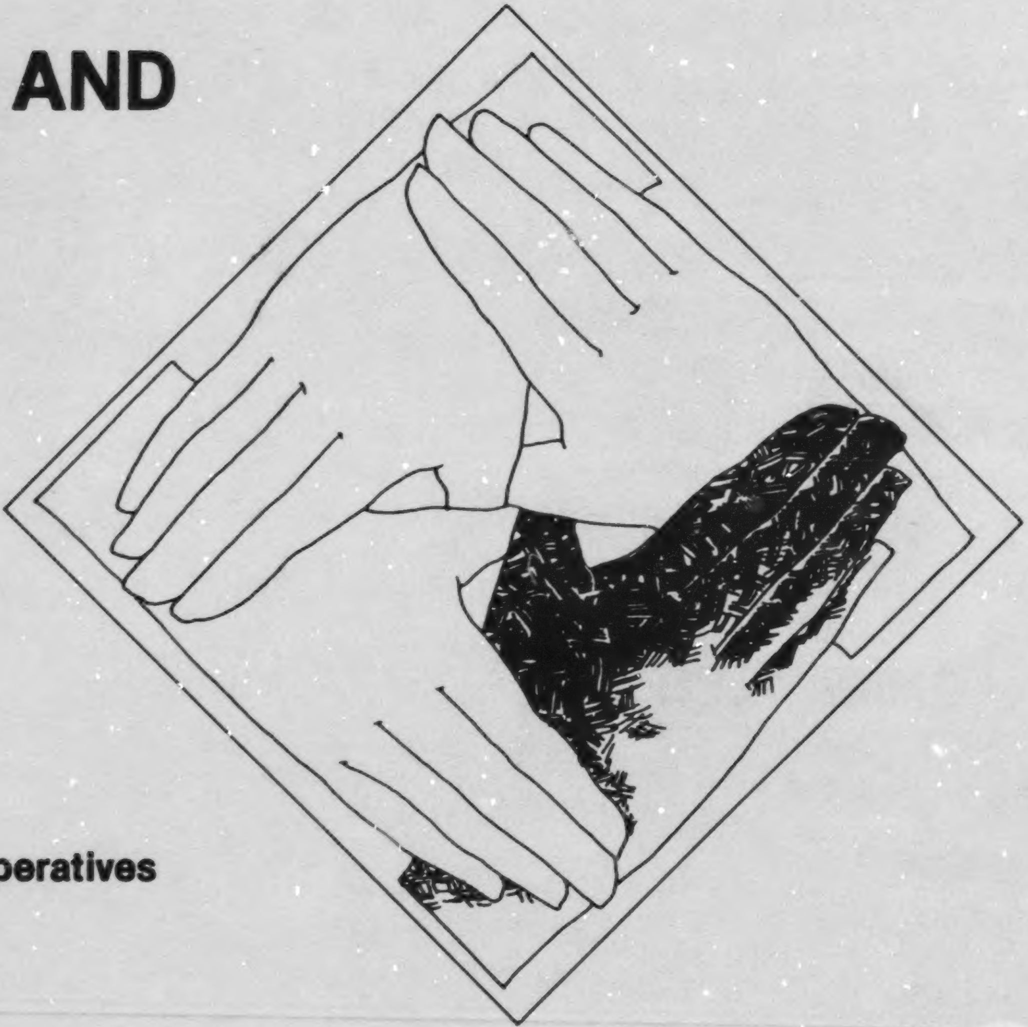
UNDERSTANDING YOUR COOPERATIVES

ECONOMICS, STATISTICS,
AND COOPERATIVES
SERVICE

Ag IV - V - 79

PRINCIPLES AND PRACTICES

Ag IV - V - 80



LESSON 1

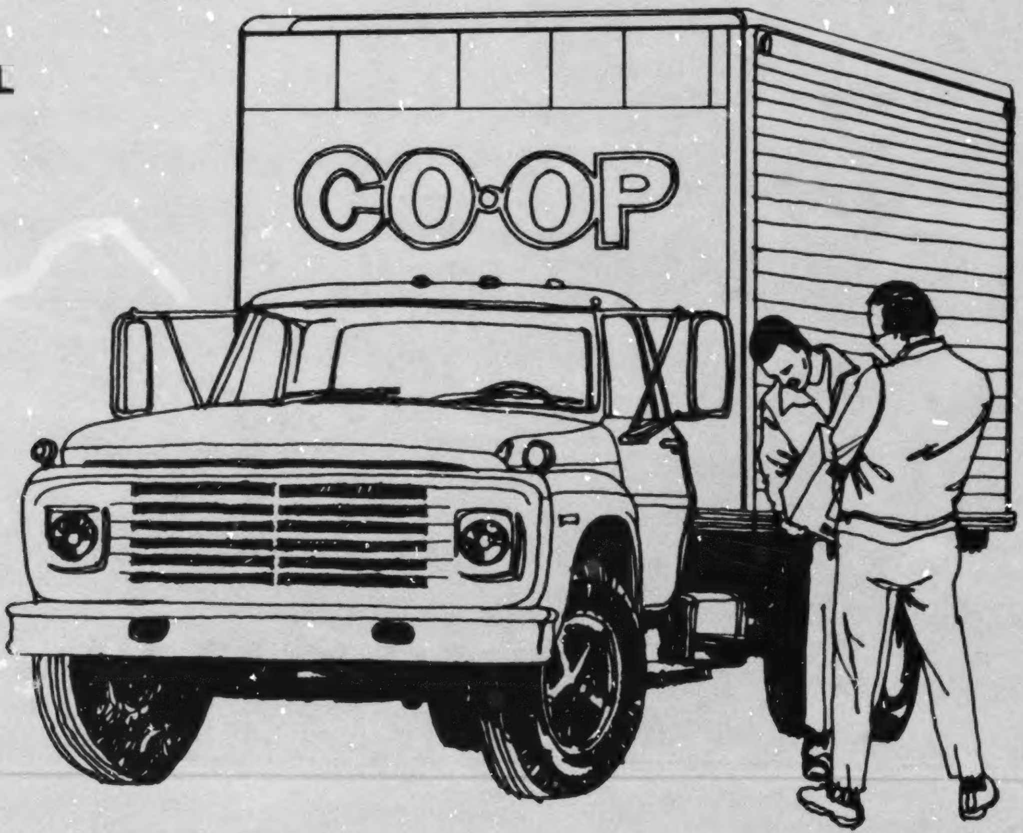
Understanding your cooperatives

1-1

WHAT DOES COOPERATION MEAN?

JOINING OF RESOURCES

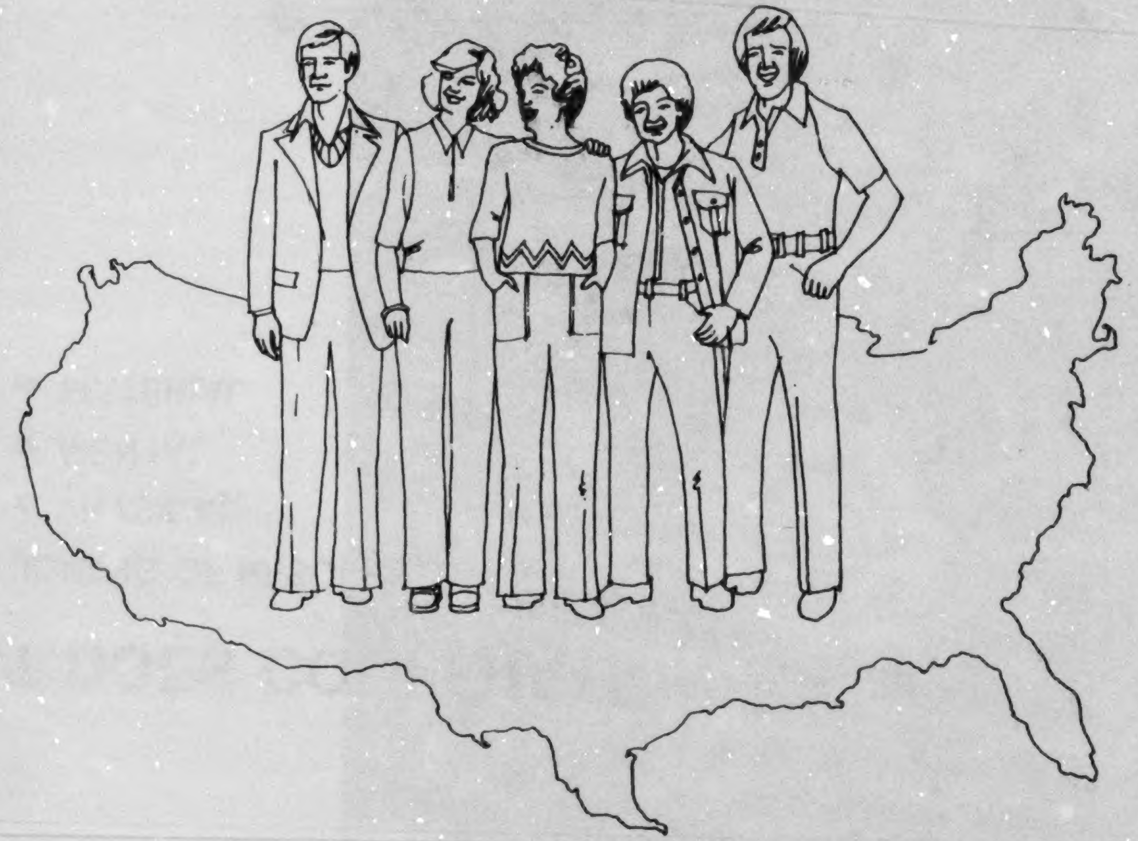
- PHYSICAL
- MENTAL
- MATERIAL



Ag IV - V - 81

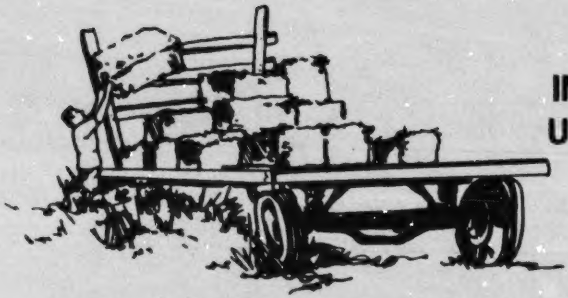
WHY COOPERATE?

- FOR MUTUAL BENEFIT

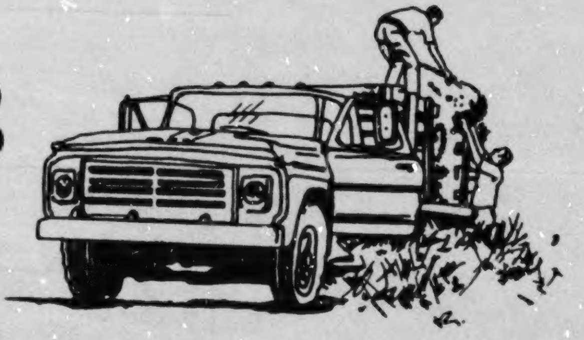


Ag IV - V - 82

WHAT ARE TWO BASIC TYPES OF COOPERATION?

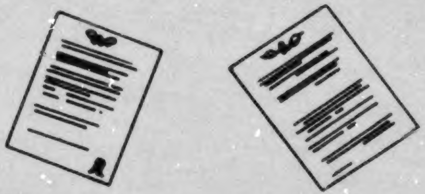


INFORMAL AND UNSTRUCTURED



— — — — —FORMALLY ORGANIZED— — — — —

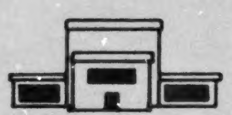
NONBUSINESS



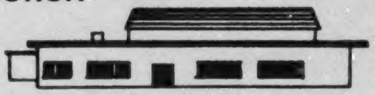
BUSINESS

CHURCH

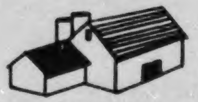
COMMUNITY CLUB



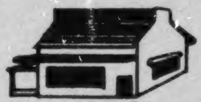
CO-OP



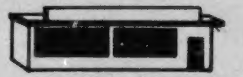
SCHOOL



FARM ORGANIZATION

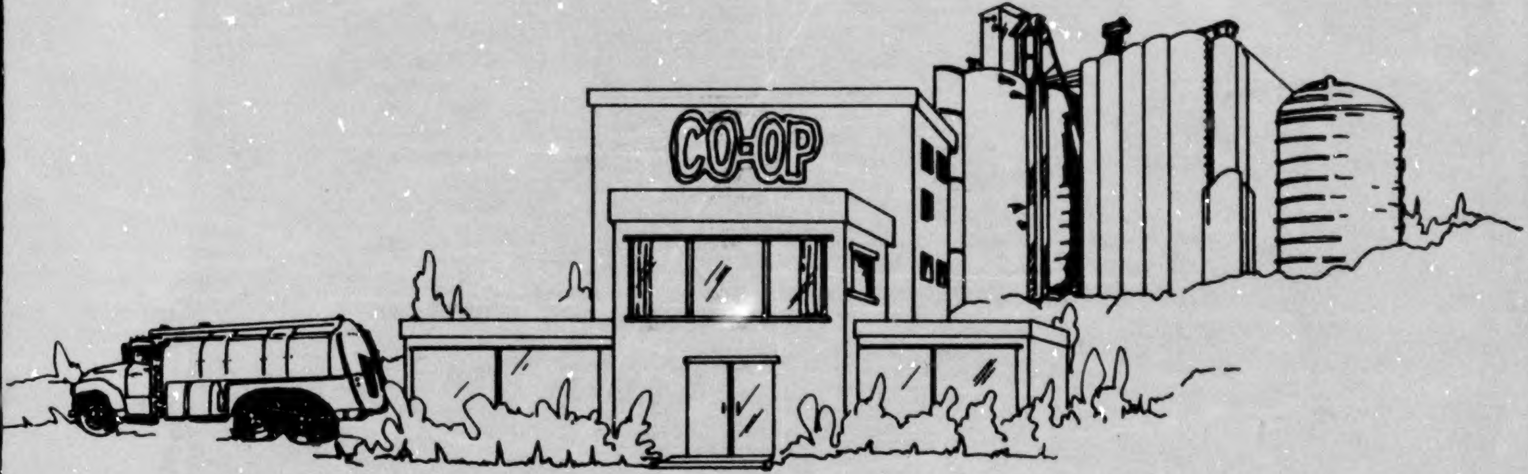


BANK



CREDIT UNION

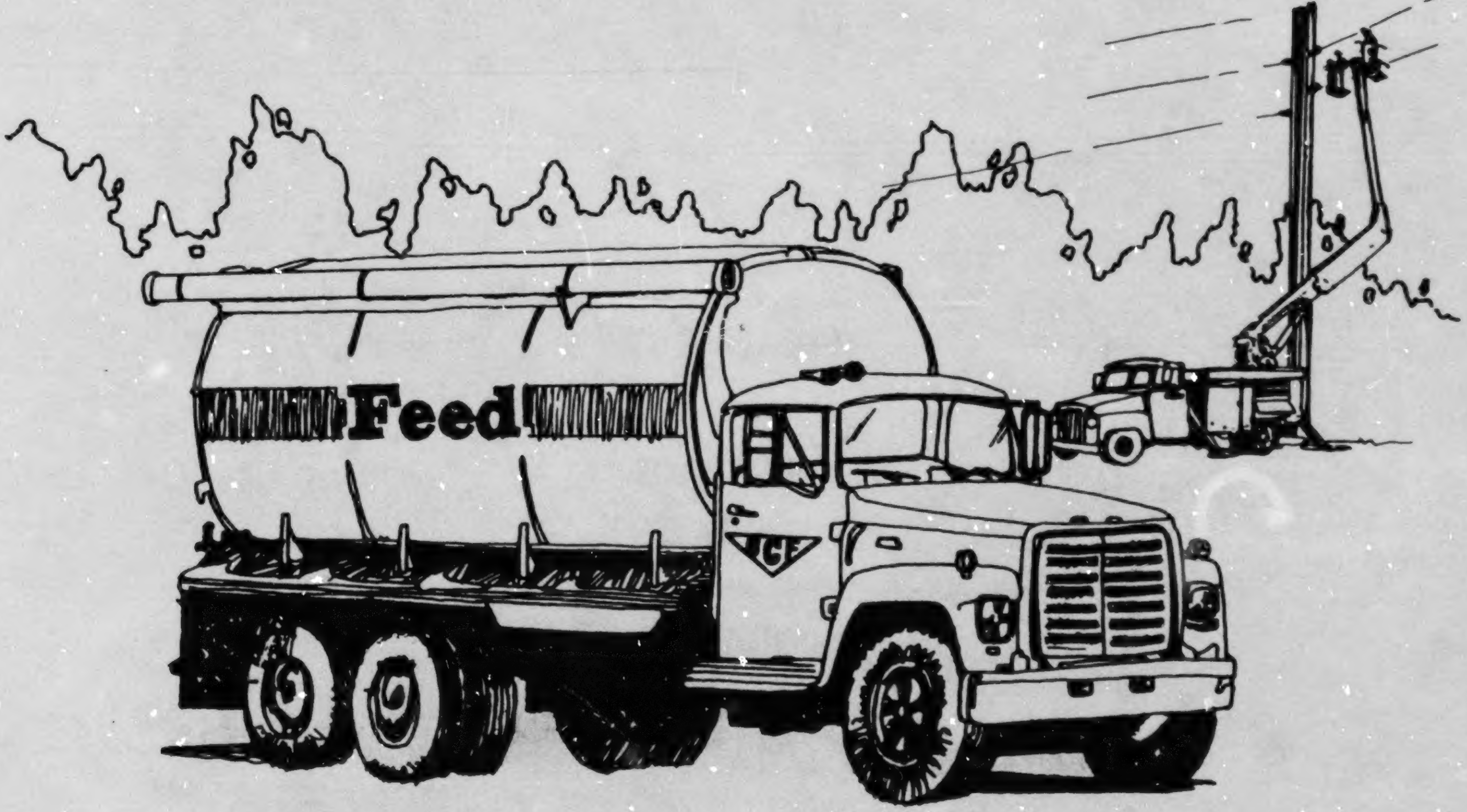
WHAT IS A COOPERATIVE BUSINESS?



A cooperative is a business voluntarily owned and controlled by its users and operated for them on a nonprofit basis.

1-5

WHAT DOES A COOPERATIVE DO?



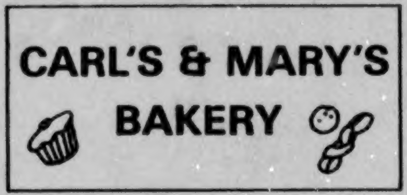
PROVIDES ITS USER-OWNERS GOODS AND SERVICES AT COST

WHERE DOES A COOPERATIVE FIT IN THE AMERICAN PRIVATE COMPETITIVE ENTERPRISE SYSTEM?

TYPES OF BUSINESSES:

JOE'S T.V. REPAIR

INDIVIDUAL

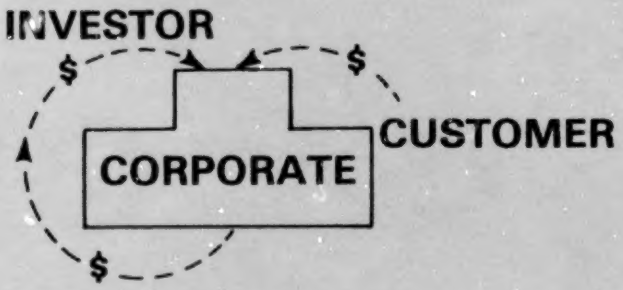


CARL'S & MARY'S BAKERY

PARTNERSHIP

NORTHERN HARDWARE INC.

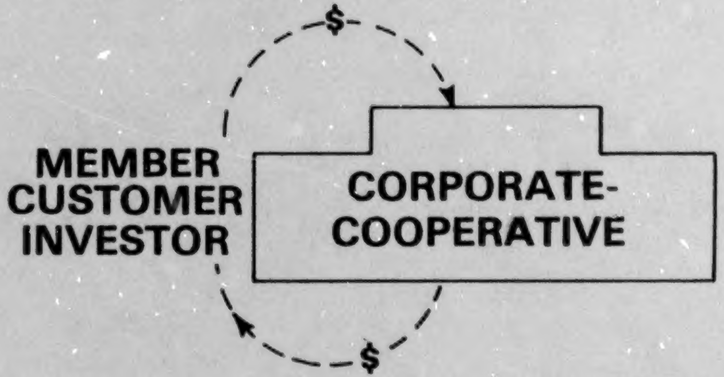
CORPORATE



INVESTOR

CUSTOMER

CORPORATE



MEMBER CUSTOMER INVESTOR

CORPORATE-COOPERATIVE

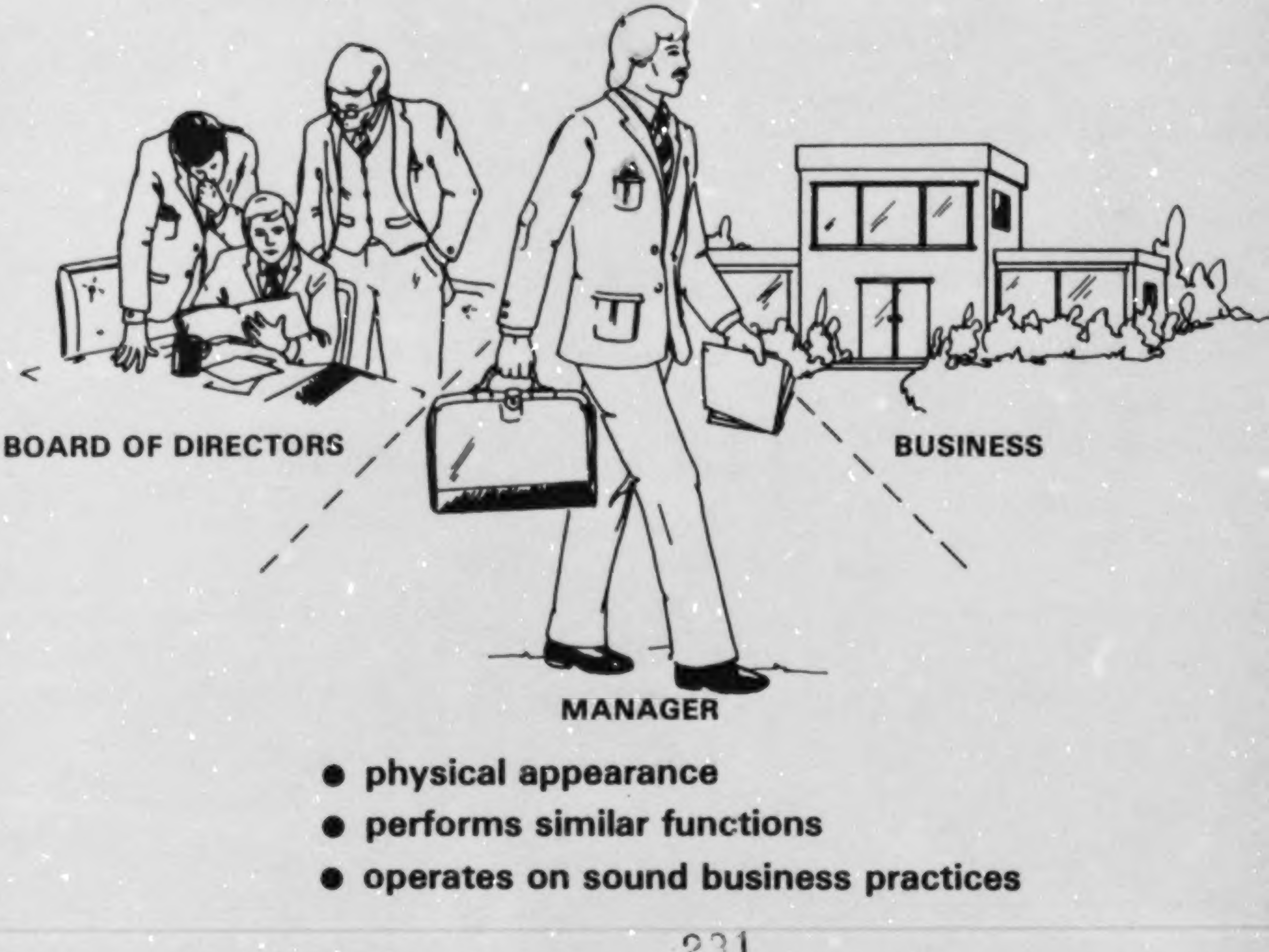
WHAT ARE THE FEATURES OF THE METHODS OF DOING BUSINESS?

FEATURES COMPARED	TYPES OF BUSINESS			
			CORPORATION	
	INDIVIDUAL	PARTNERSHIP	INVESTOR-ORIENTED	COOPERATIVE
1. Who uses the services?	Nonowner customers	Generally nonowner customers	Generally nonowner customers	Chiefly the owner patrons
2. Who owns the business?	The individual	The partners	The stockholders	The member-patrons
3. Who votes?	None Necessary	The partners	Common stockholders	The member-patrons[1]
4. How is voting done?	None Necessary	Usually by partners' share in capital	By shares of common stock	Usually one-member, one-vote
5. Who determines policies?	The individual	The partners	Common stockholders and directors	The member-patrons and directors
6. Are returns on ownership capital limited?	No	No	No	Yes—8% or less (usually less, if any)[1]
7. Who gets the operating proceeds?	The individual	The partners in proportion to interest in business	The stockholders in proportion to stock held	The patrons on a patronage basis[1]

---

[1] Basis cooperative principles.

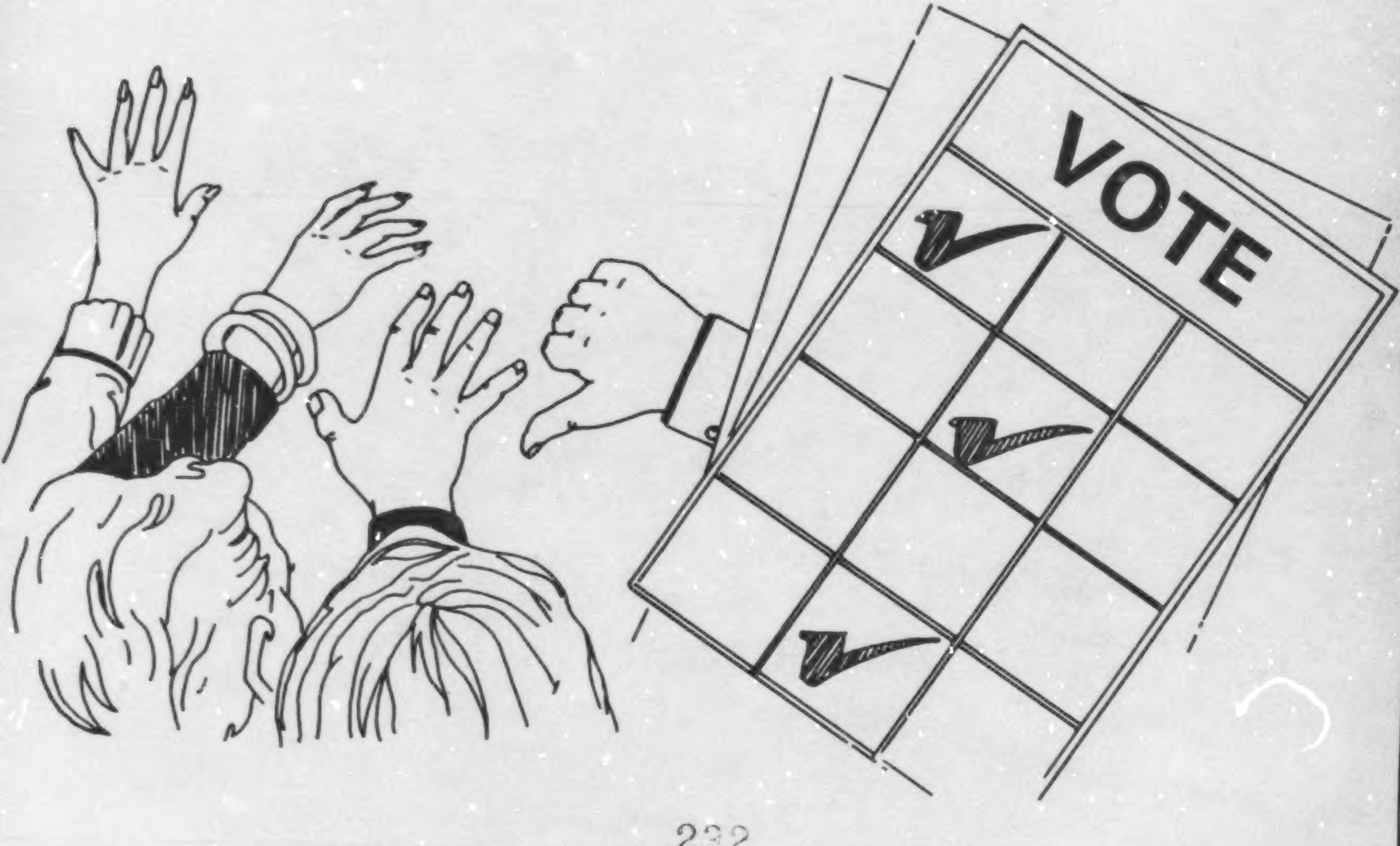
HOW IS A COOPERATIVE LIKE OTHER BUSINESSES?


BOARD OF DIRECTORS
BUSINESS
MANAGER

- physical appearance
- performs similar functions
- operates on sound business practices

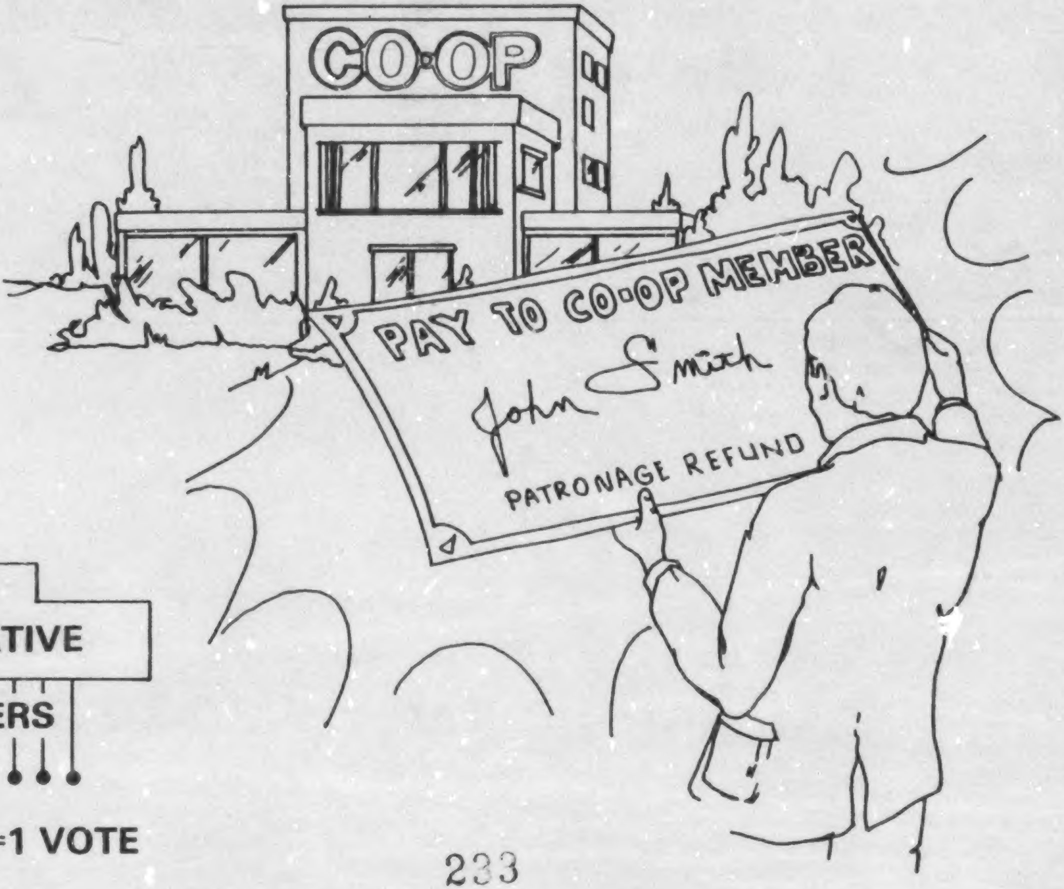
HOW IS A COOPERATIVE DISTINCTIVE?

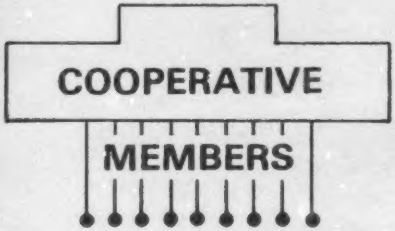
- DEMOCRATICALLY CONTROLLED — VOLUNTARY PARTICIPATION



HOW IS A COOPERATIVE DISTINCTIVE?

- DEMOCRATICALLY CONTROLLED
- **SERVICE AT COST**


CO-OP
PAY TO CO-OP MEMBER
John Smith
PATRONAGE REFUND



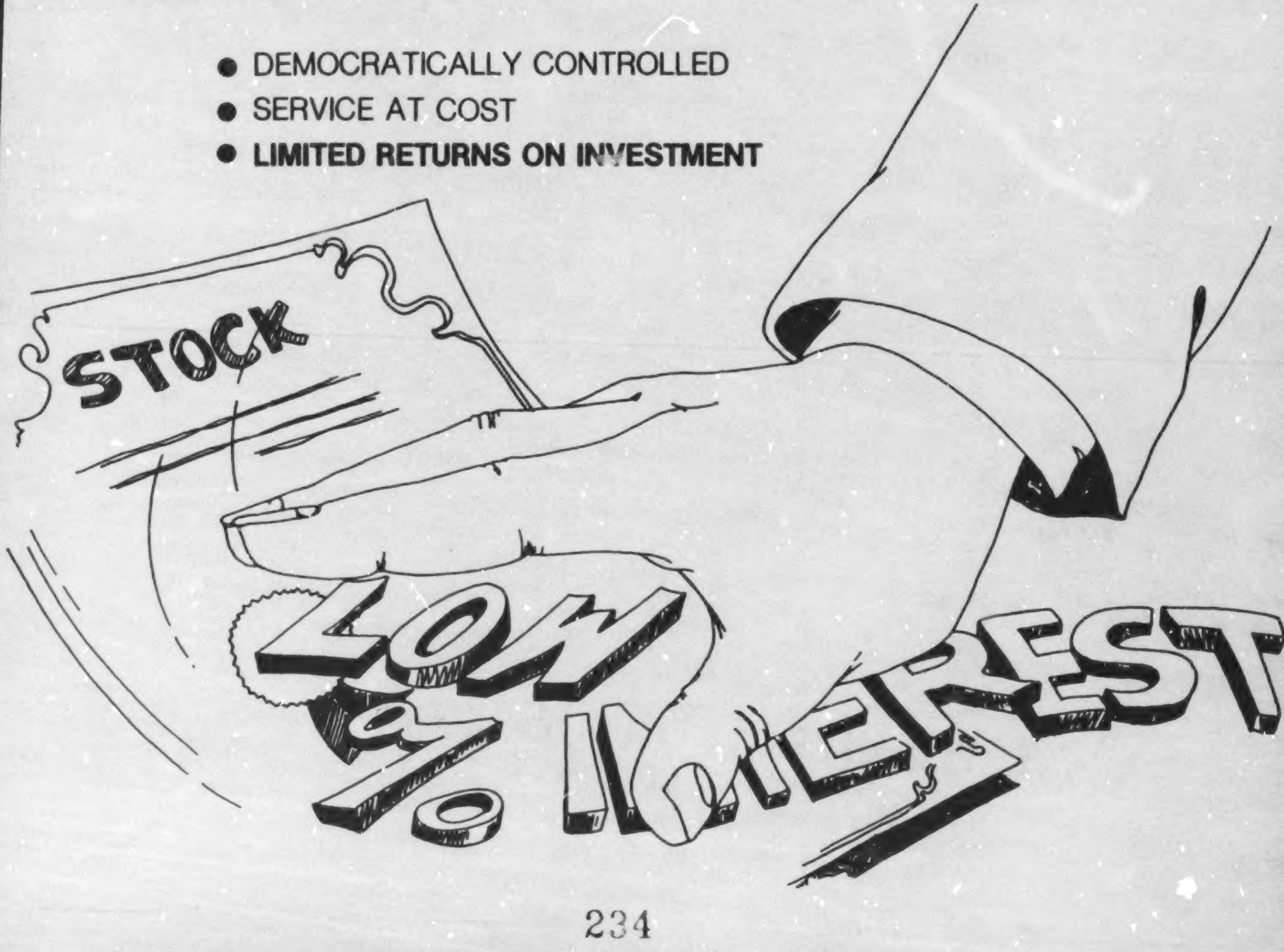
COOPERATIVE

MEMBERS

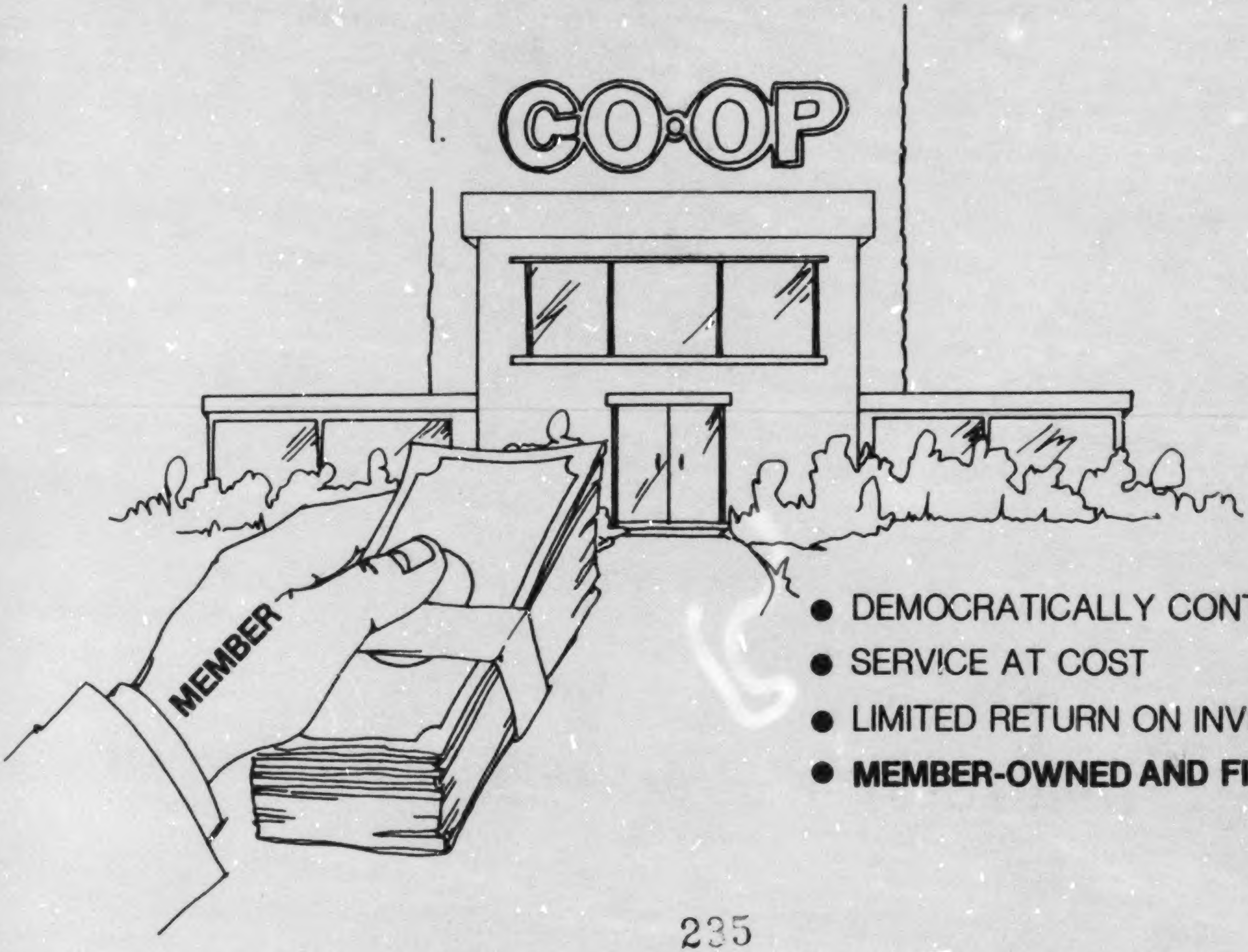
1 MEMBER=1 VOTE

HOW IS A COOPERATIVE DISTINCTIVE?

- DEMOCRATICALLY CONTROLLED
- SERVICE AT COST
- **LIMITED RETURNS ON INVESTMENT**

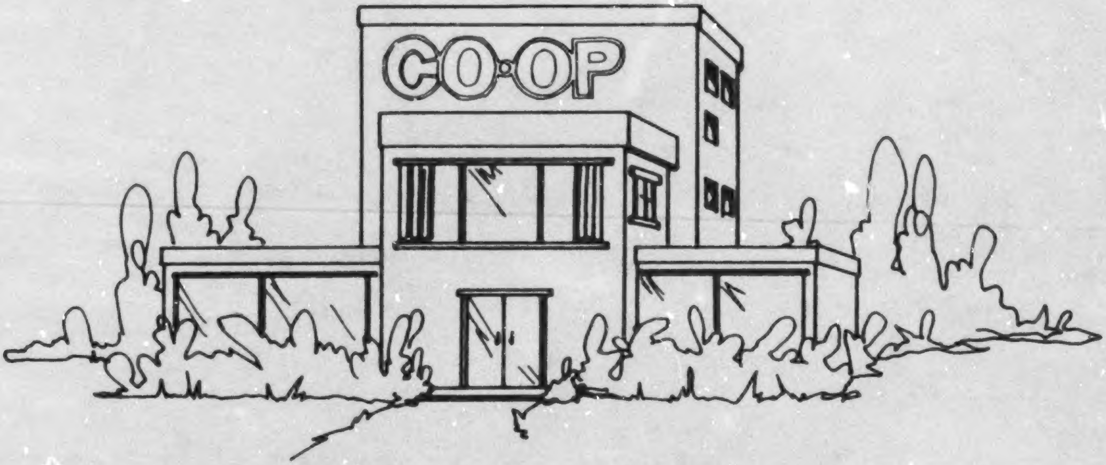

STOCK
LOW % INTEREST

HOW IS A COOPERATIVE DISTINCTIVE?



- DEMOCRATICALLY CONTROLLED
- SERVICE AT COST
- LIMITED RETURN ON INVESTMENT
- **MEMBER-OWNED AND FINANCED**

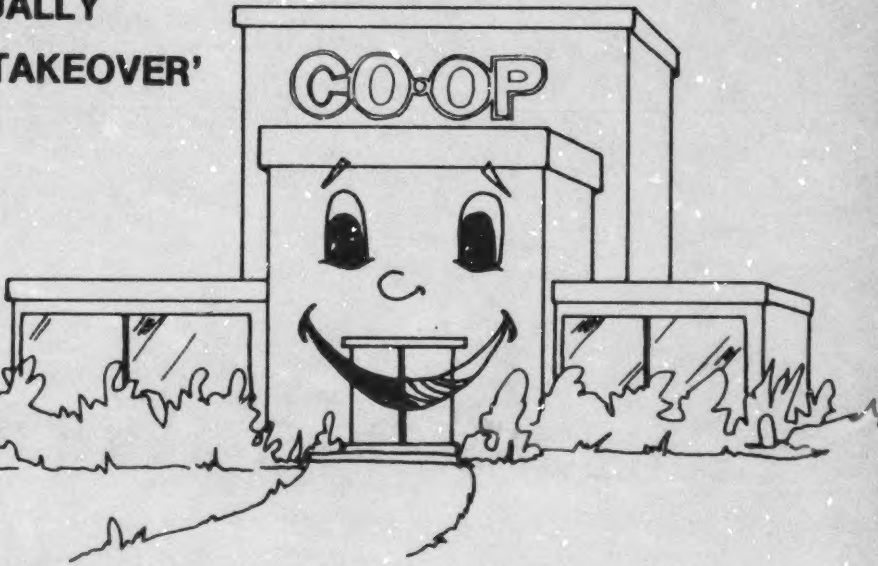
HOW IS A COOPERATIVE DISTINCTIVE?



- DEMOCRATICALLY CONTROLLED
- SERVICE AT COST
- LIMITED RETURN ON INVESTMENT
- MEMBER OWNED AND FINANCED
- **OPERATIONS ARE LIMITED**

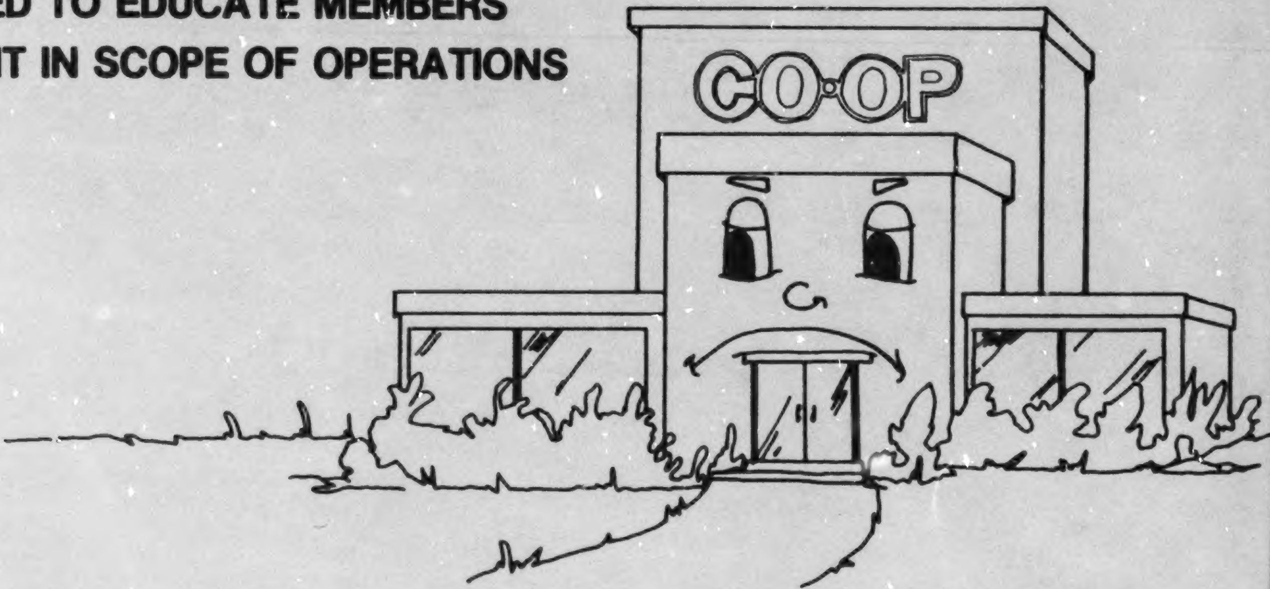
WHAT ARE THE ADVANTAGES OF A COOPERATIVE?

- BENEFITS TIED TO USE
- CONTROL SHARED EQUALLY
- SAFE FROM OUTSIDE 'TAKEOVER'

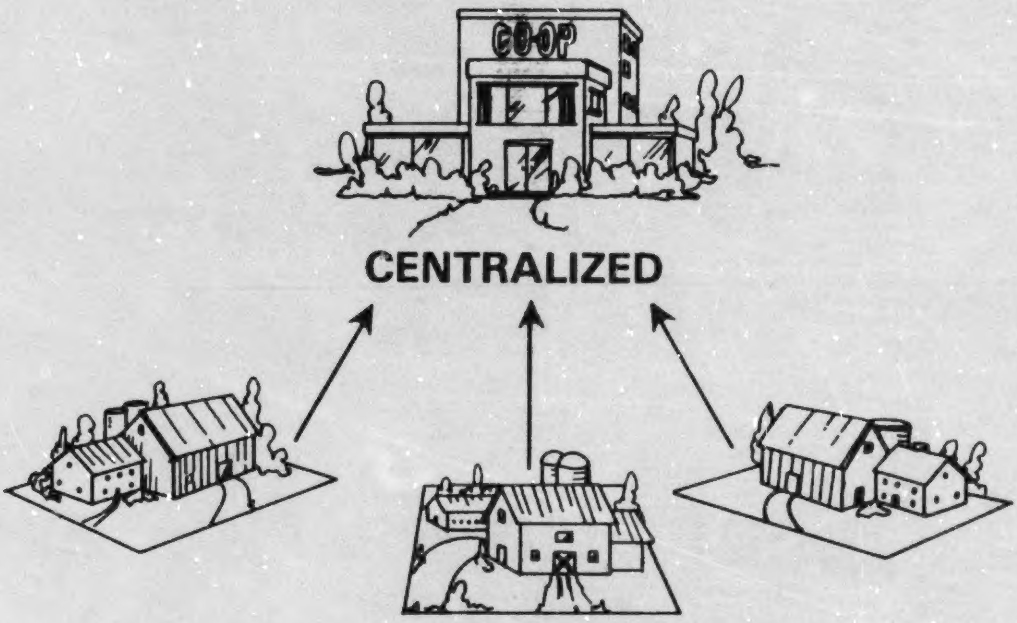


WHAT ARE THE DISADVANTAGES OF A COOPERATIVE?

- SOURCES OF FINANCING LIMITED
- NEED TO EDUCATE MEMBERS
- LIMIT IN SCOPE OF OPERATIONS



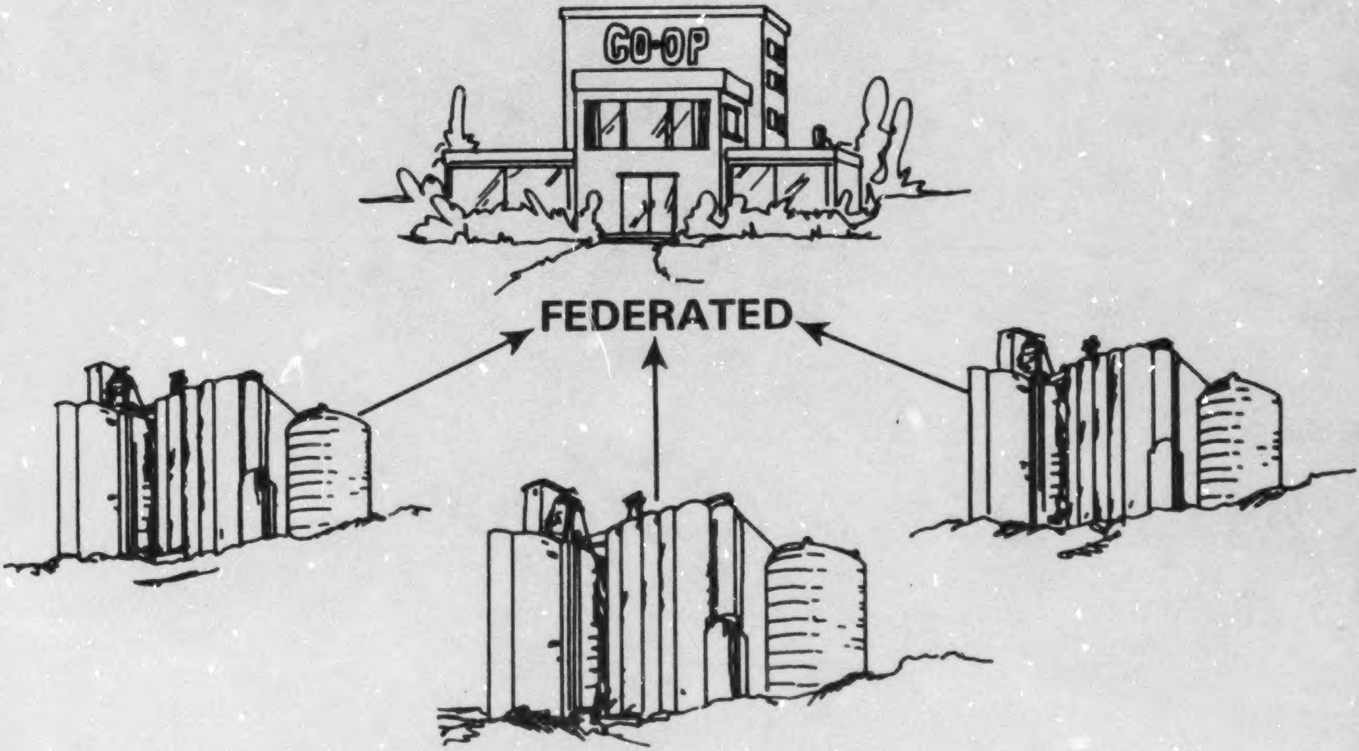
HOW ARE COOPERATIVES ORGANIZED?



CENTRALIZED

FARMER MEMBERS

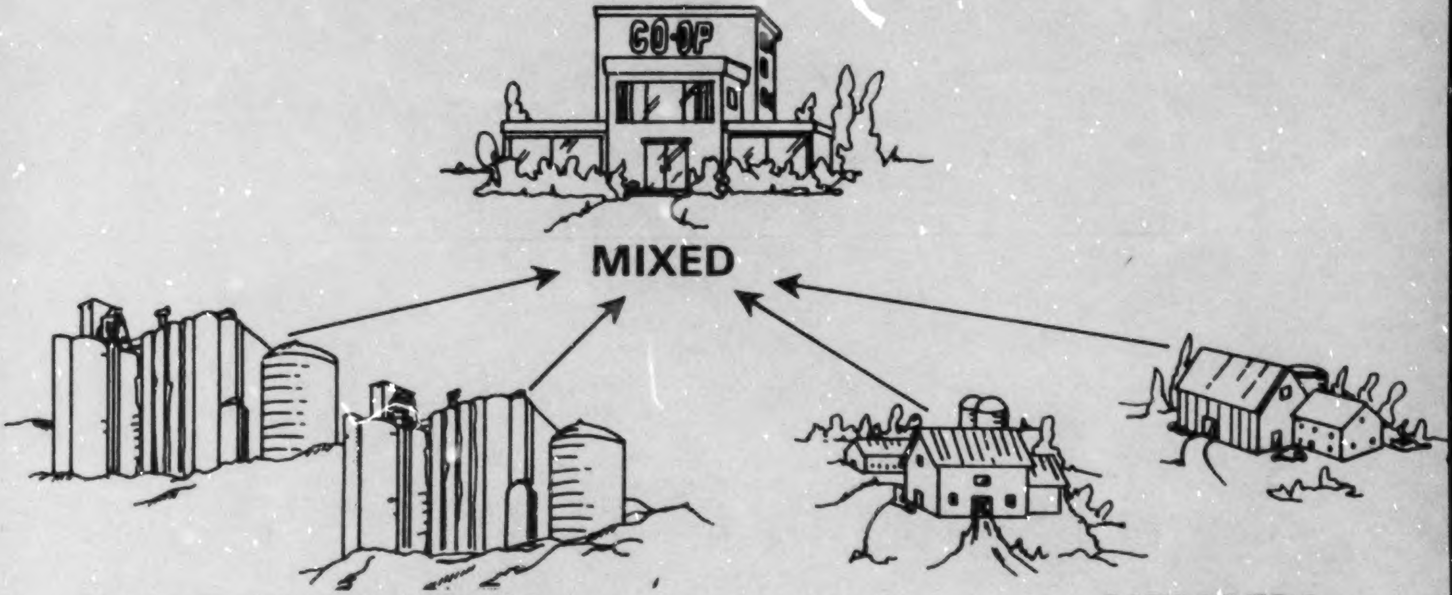
HOW ARE COOPERATIVES ORGANIZED?



FEDERATED

LOCAL COOPERATIVES

HOW ARE COOPERATIVES ORGANIZED?

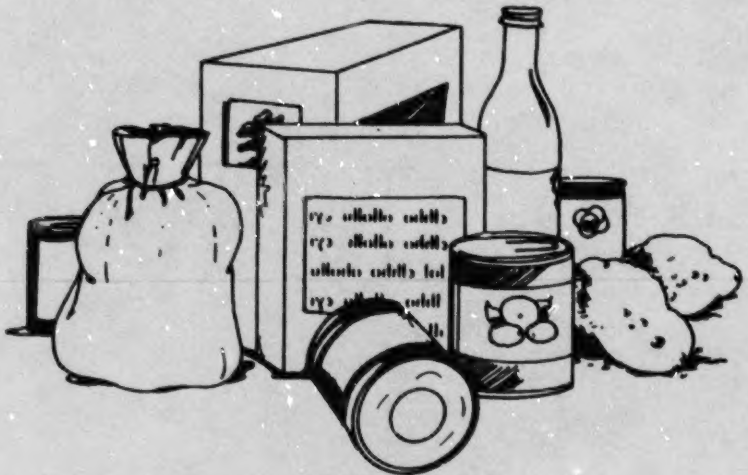


MIXED

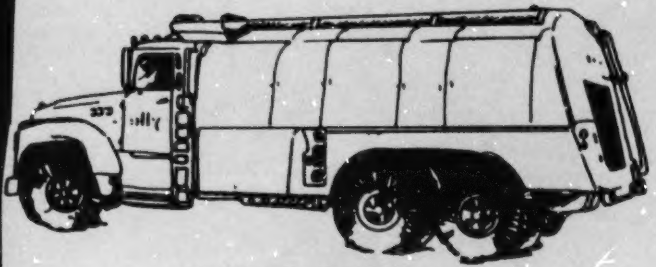
LOCAL COOPERATIVES

MEMBERS

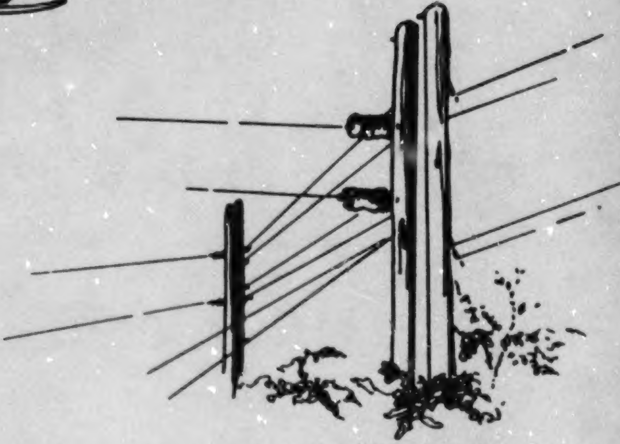
WHAT TYPES OF COOPERATIVES ARE OPERATING?



MARKETING

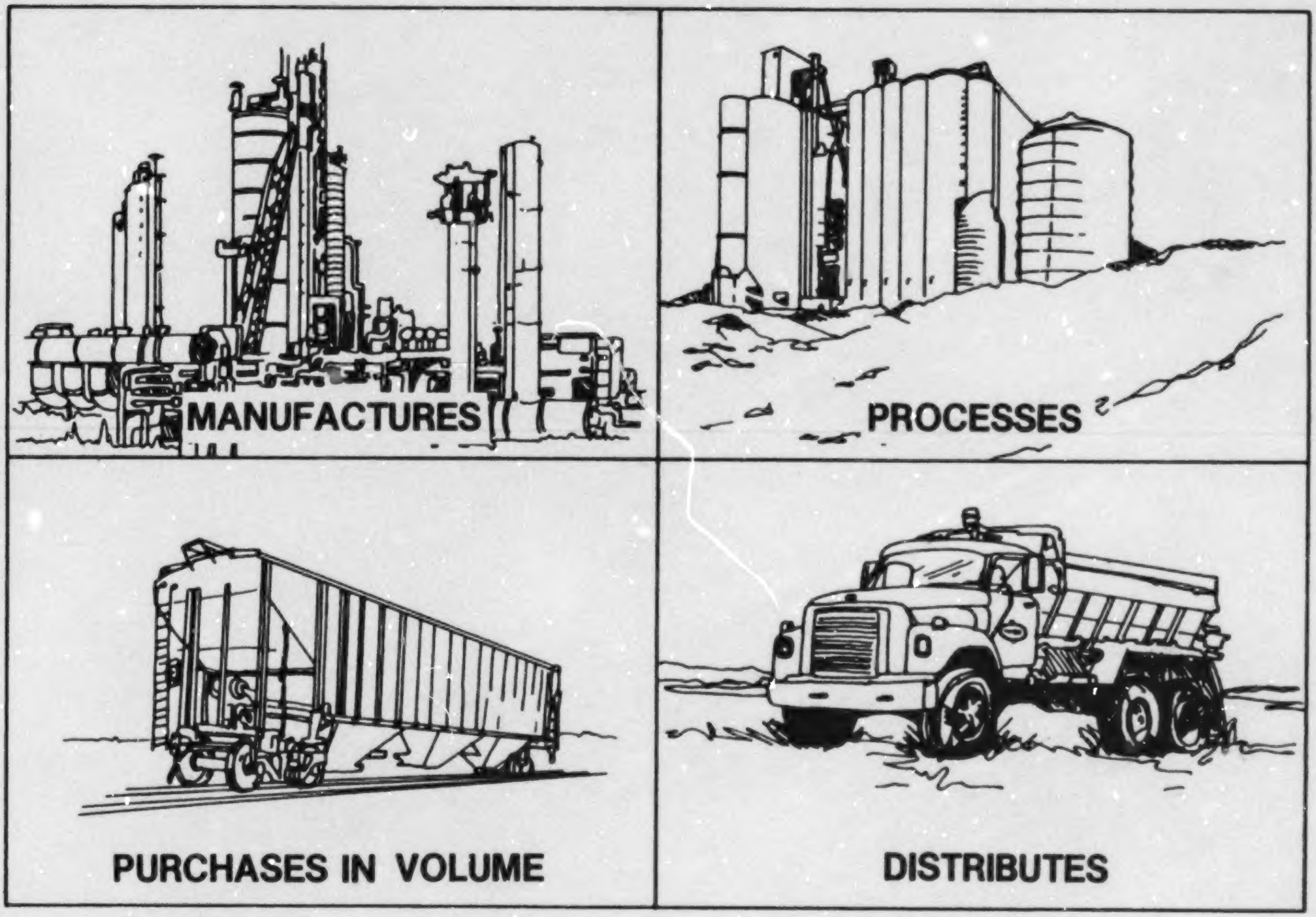


PURCHASING

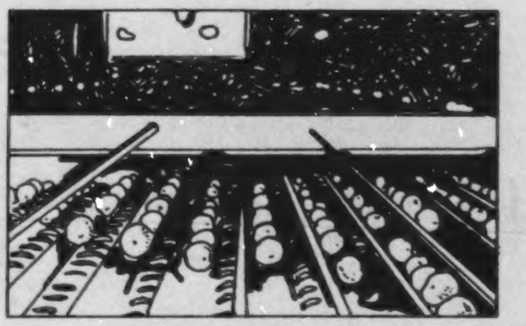


SERVICE

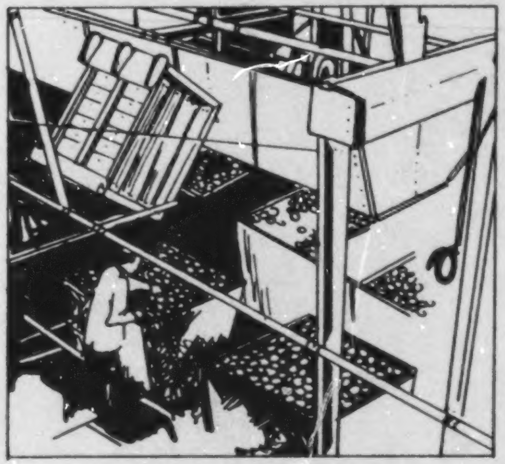
WHAT DOES A PURCHASING COOPERATIVE DO?


MANUFACTURES
PROCESSES
PURCHASES IN VOLUME
DISTRIBUTES

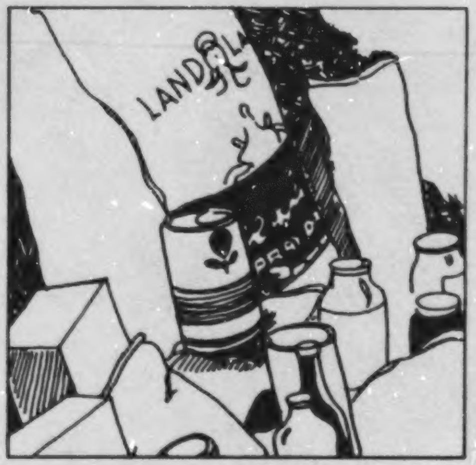
WHAT DOES A MARKETING COOPERATIVE DO?



PROCESSES



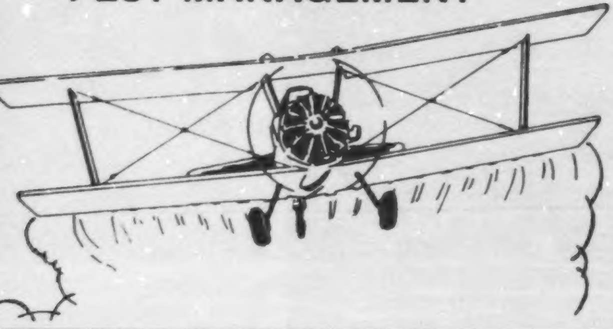
ASSEMBLES



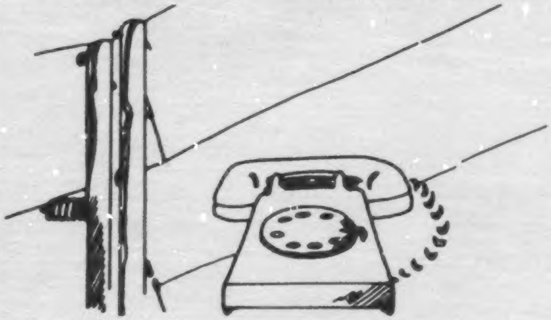
SELLS RAW AND
PROCESSED PRODUCT

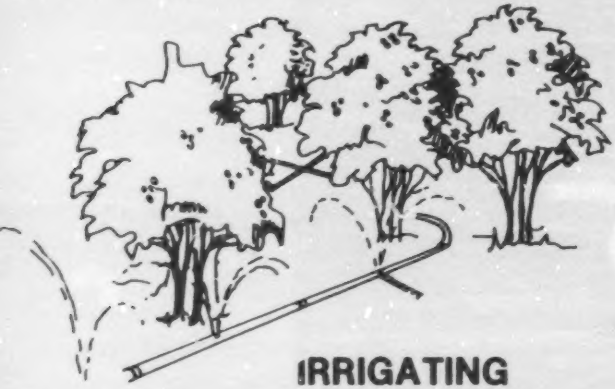
WHAT DOES A SERVICE COOPERATIVE DO?

PEST MANAGEMENT

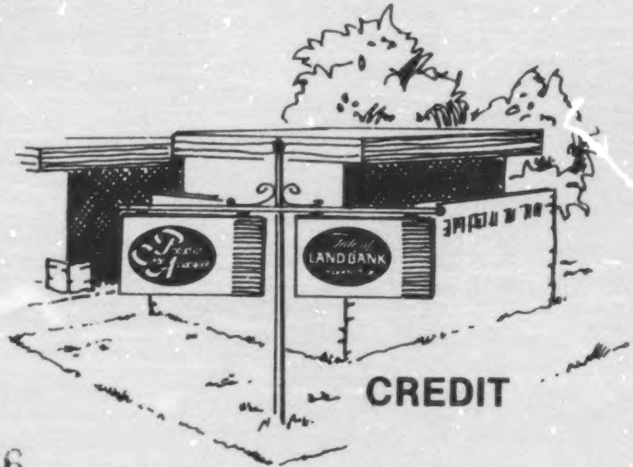


ELECTRIC - TELEPHONE





IRRIGATING

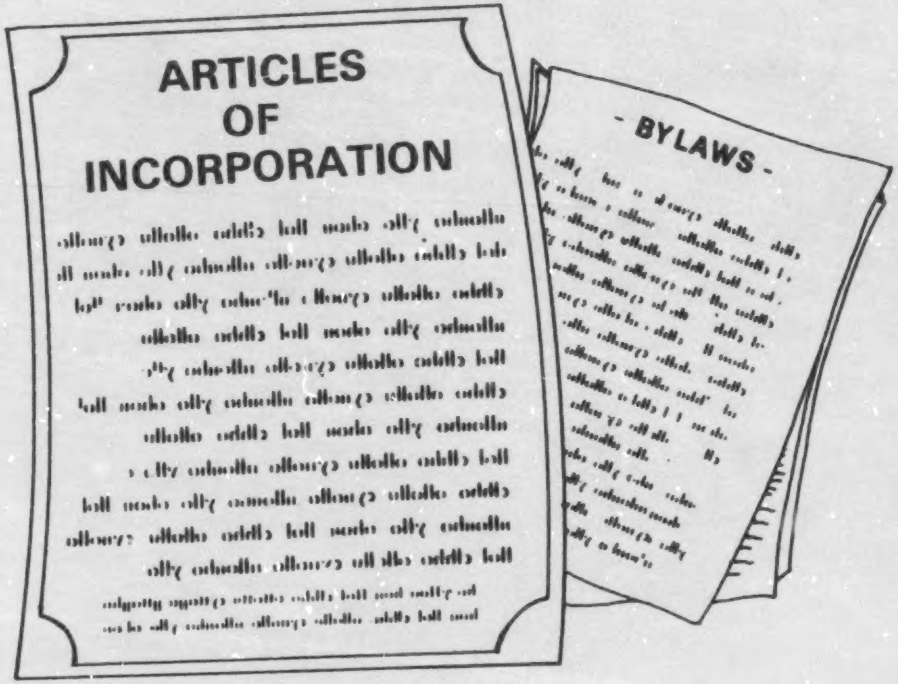

Federal
LAND BANK

CREDIT

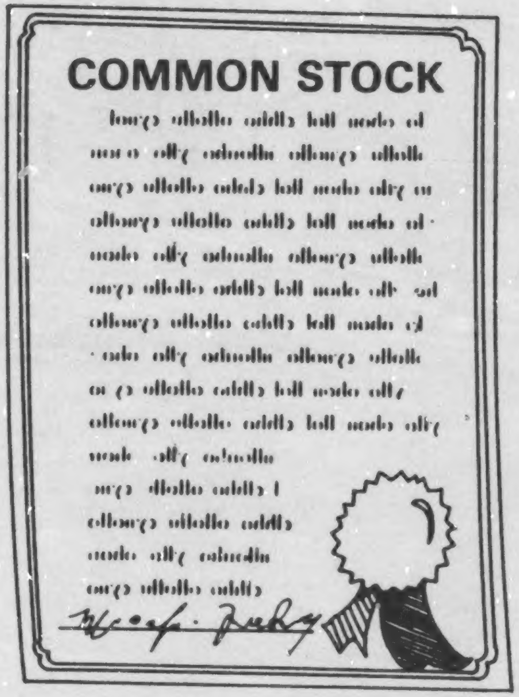
BEST COPY AVAILABLE

1-22

WHAT ARE COOPERATIVES' LEGAL STATUS?

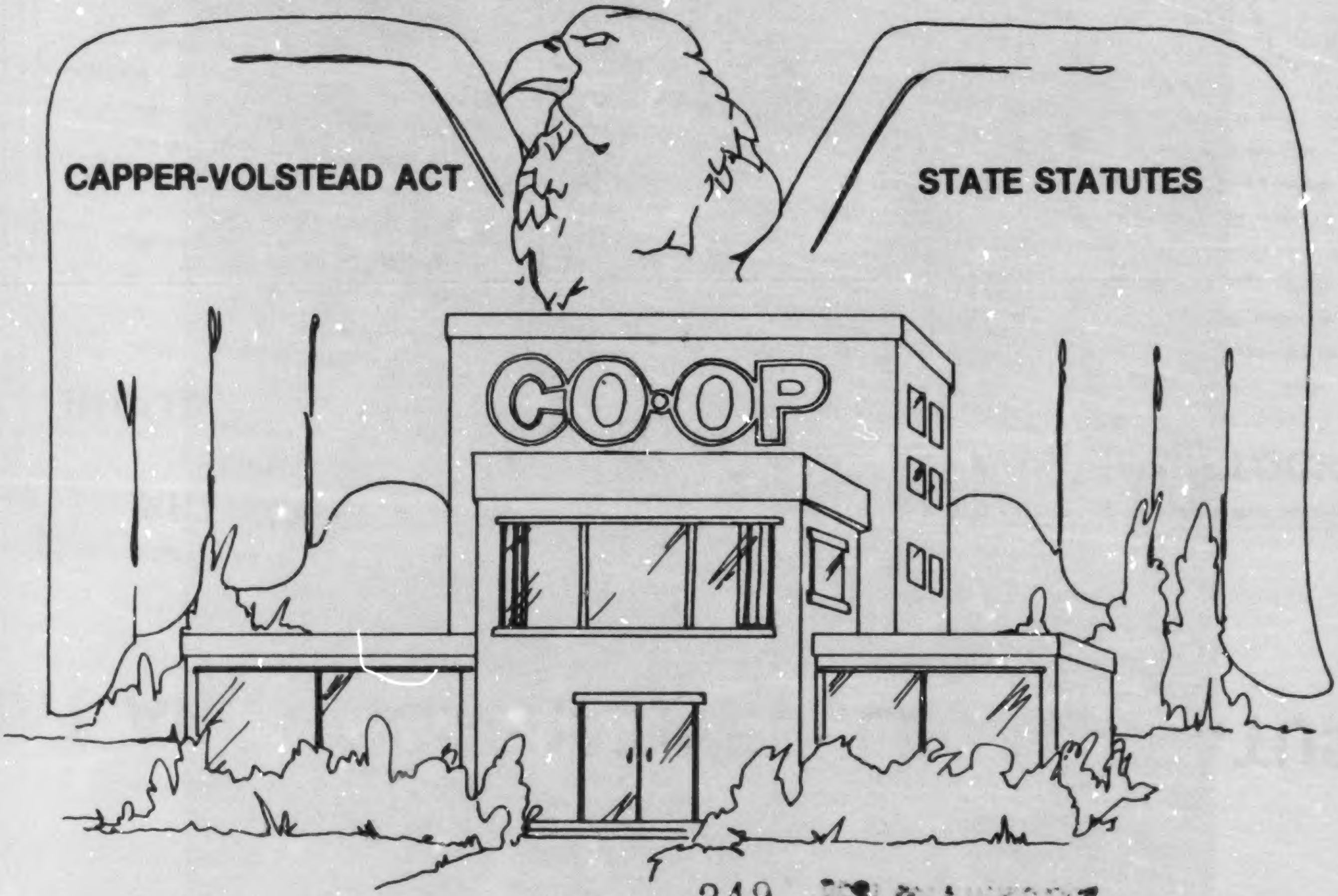

ARTICLES OF INCORPORATION
- BYLAWS -

INCORPORATED OR UNINCORPORATED


COMMON STOCK

STOCK OR NONSTOCK

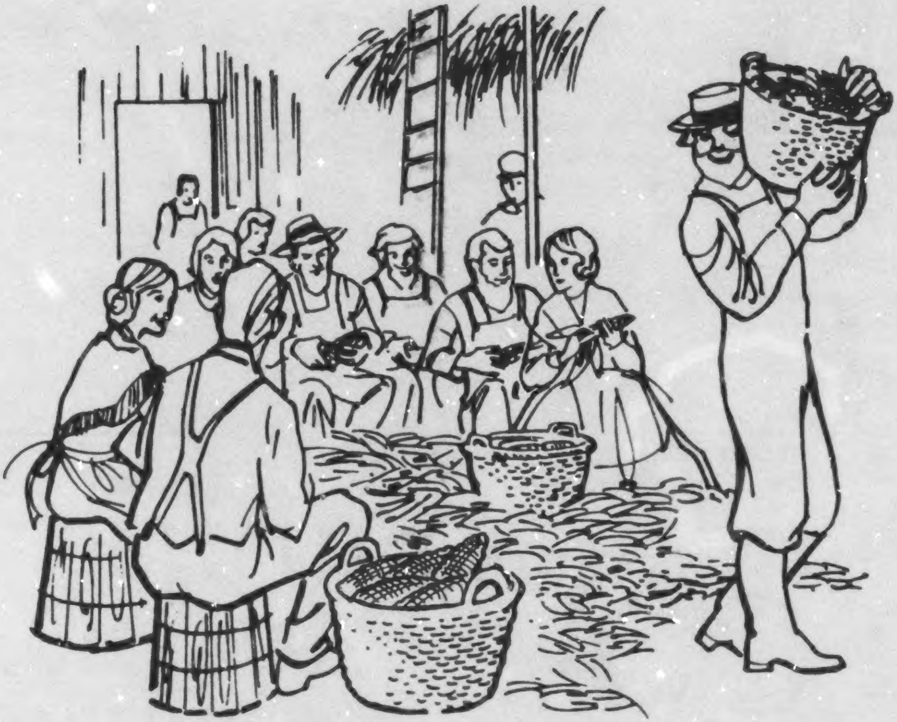
WHAT ARE COOPERATIVES' LEGAL FOUNDATIONS?


CAPPER-VOLSTEAD ACT
CO-OP
STATE STATUTES

HISTORICAL COOPERATIVE DEVELOPMENTS

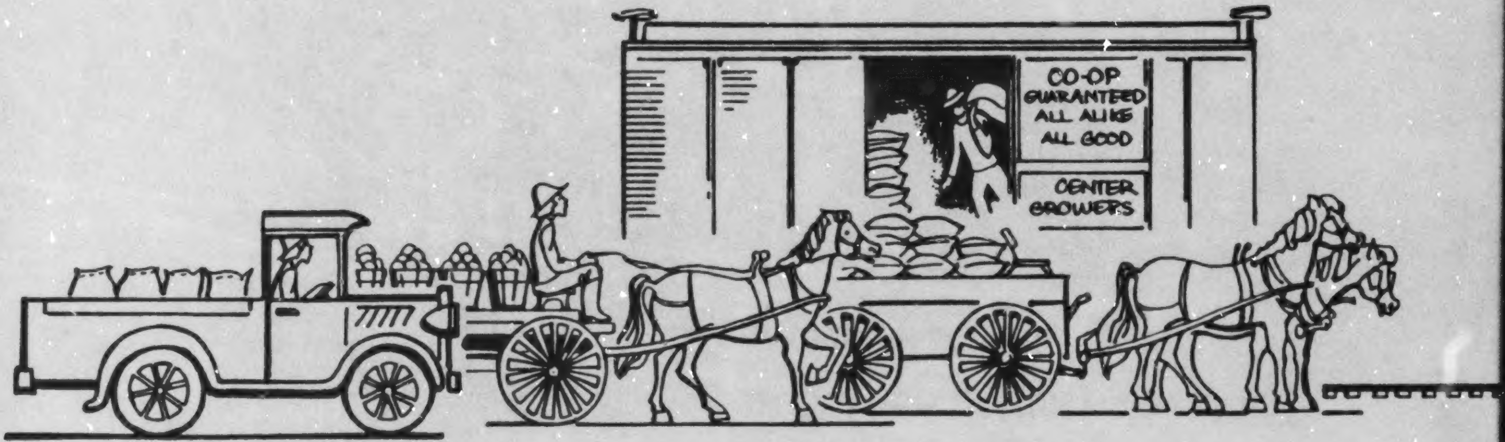
LESSON 2

Understanding your cooperatives



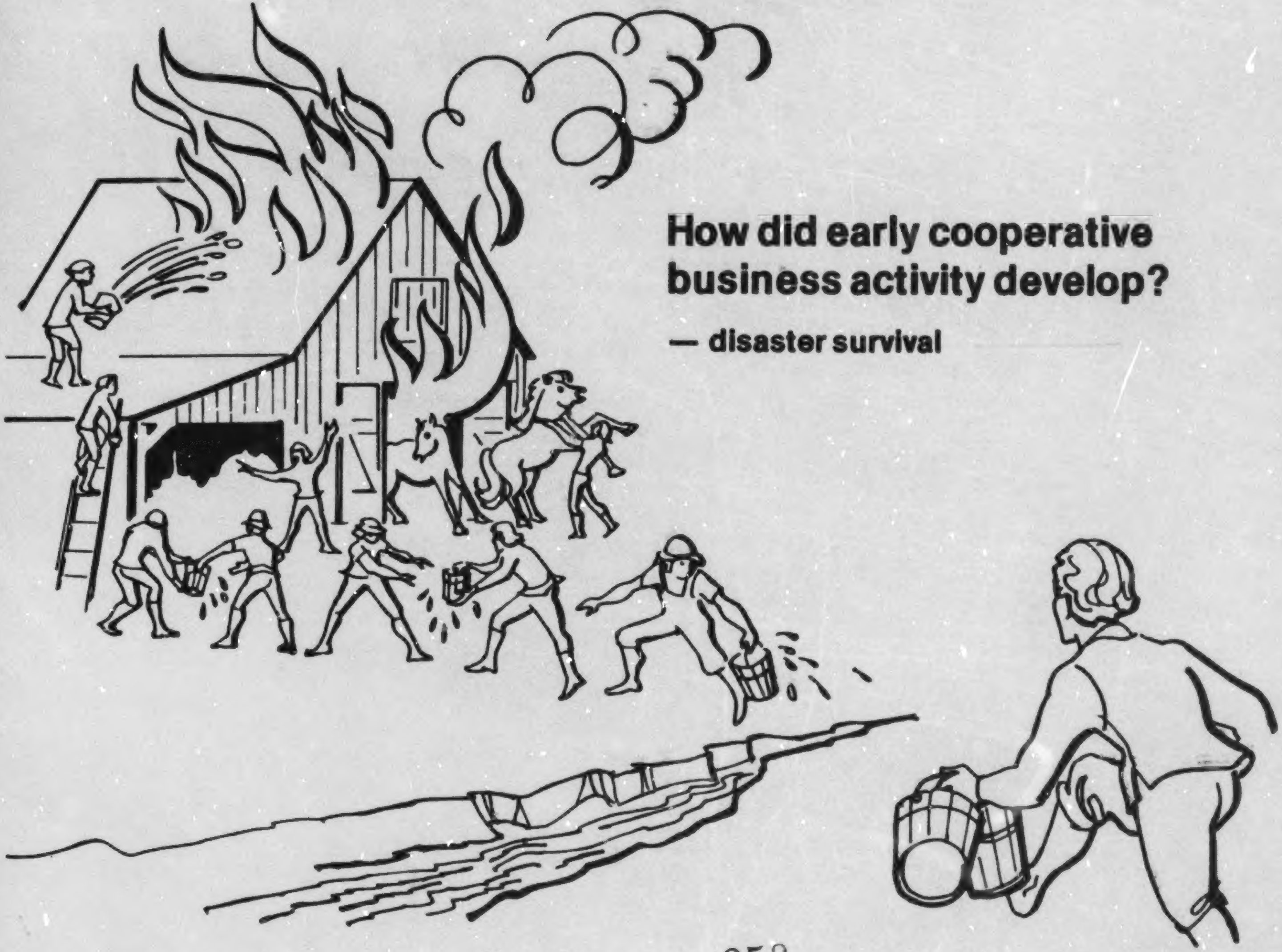
What were early forms of cooperation in this country?

- land clearing and road building
- house and barn raising
- threshing rings
- corn husking bee
- community protection


CO-OP
GUARANTEED
ALL ALIKE
ALL GOOD
CENTER
GROWERS

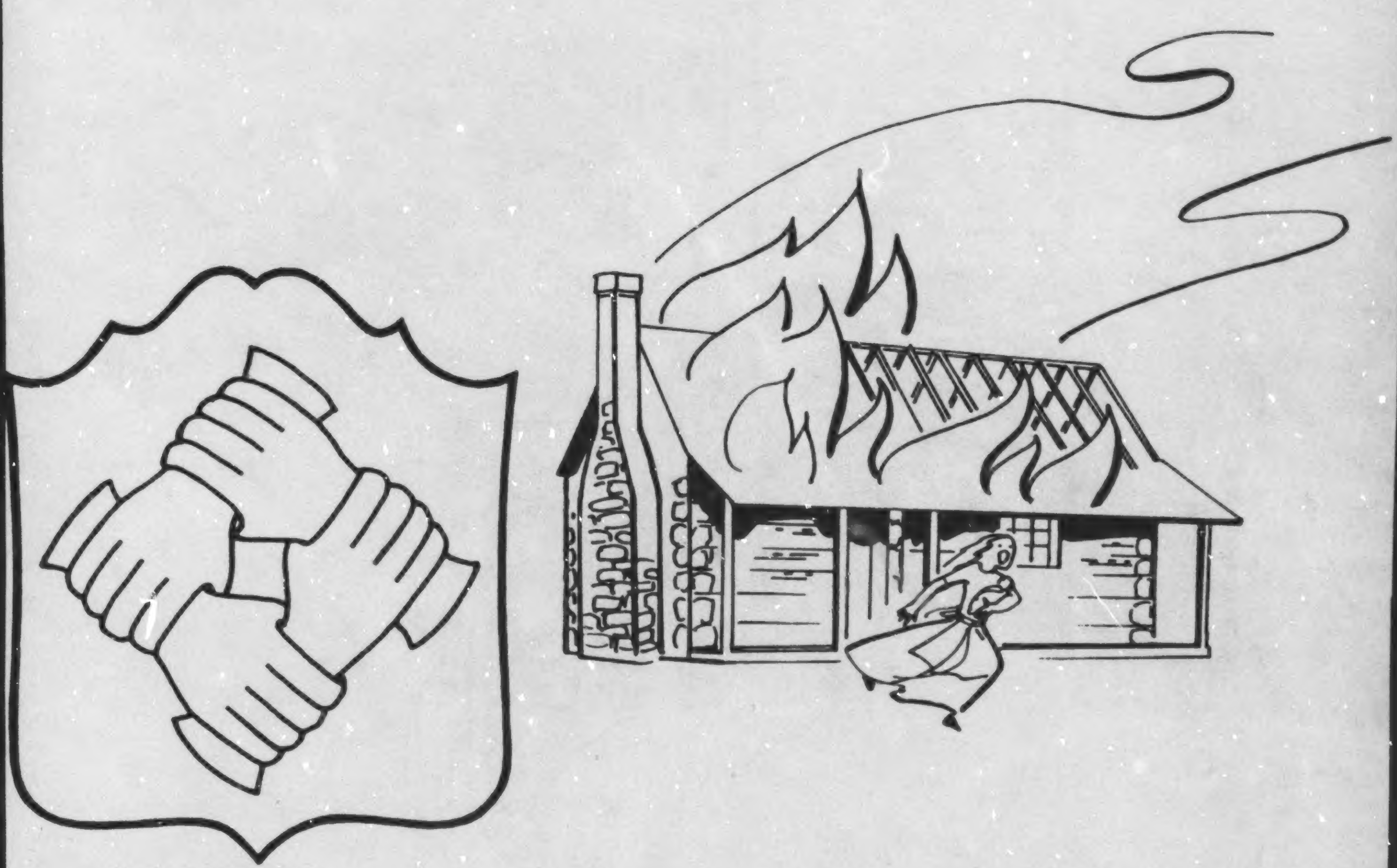
How did early cooperative business activity develop?

- — marketing products
- — pooling orders for supplies



How did early cooperative business activity develop?

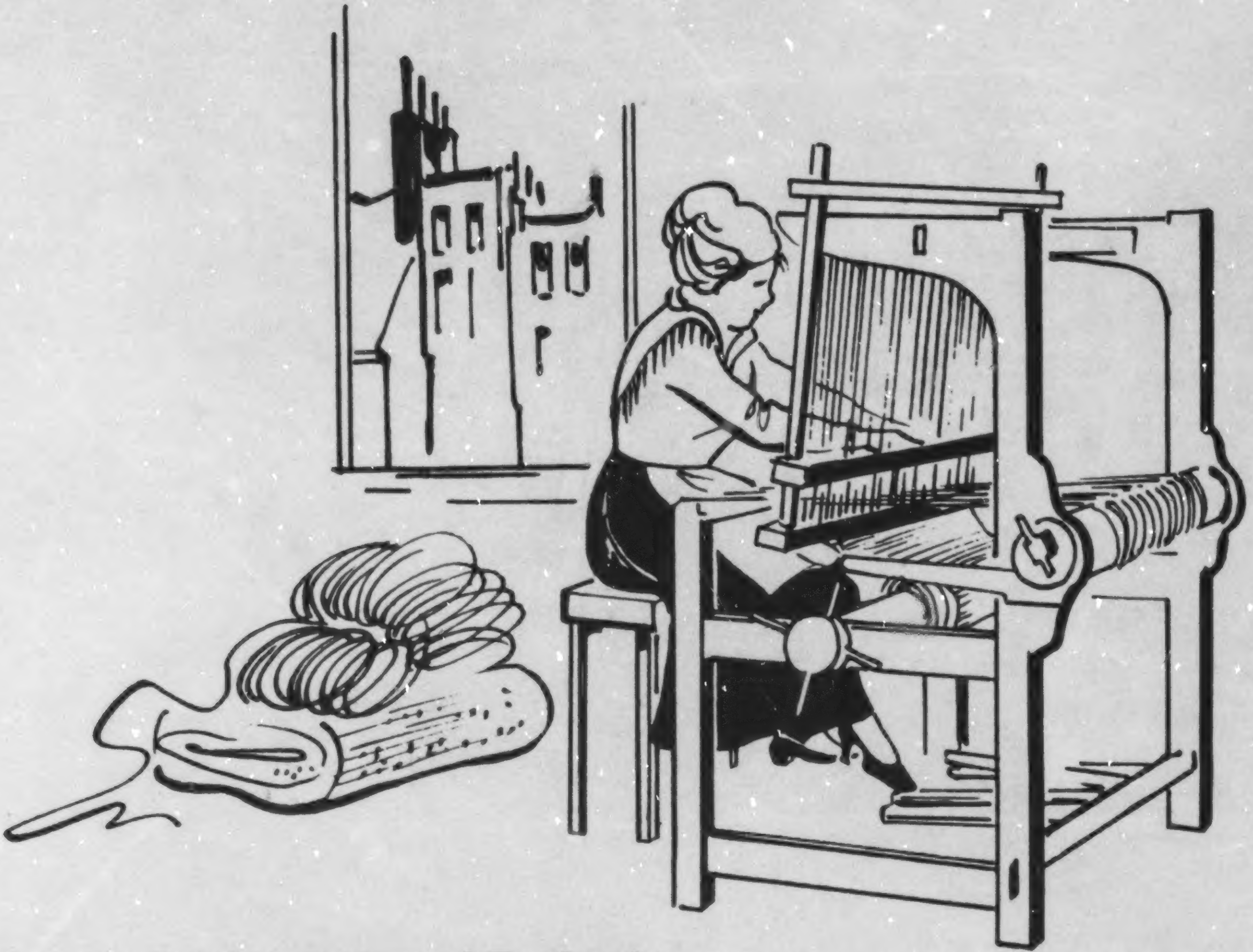
— disaster survival



What were some of the earliest cooperative businesses?

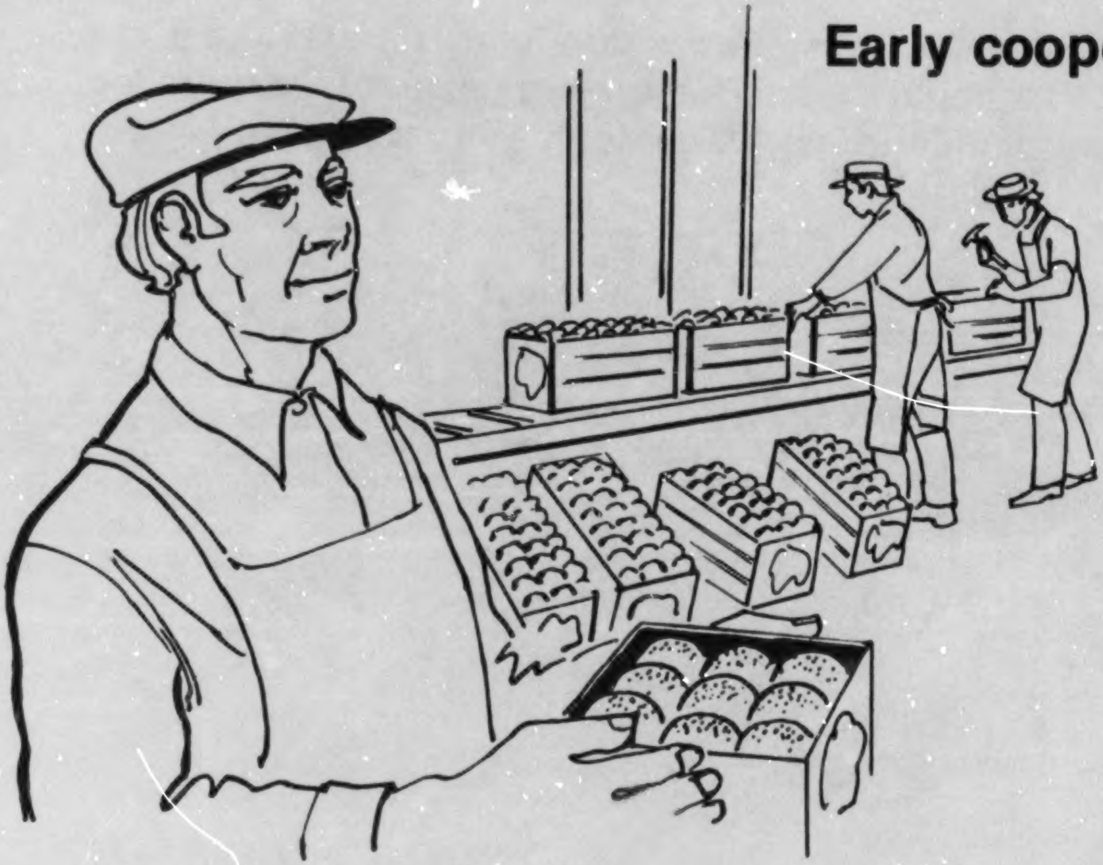
1752 — Philadelphia Contributorship for the Insurance of Homes from Loss of Fire, Benjamin Franklin.

Early cooperative of special note:



1844 — Rochdale weavers of England

Early cooperatives:



1885 — Orange Growers Protective Union of Southern California, first citrus cooperative. Followed in 1905 by the California Fruit Growers Exchange, now known as Sunkist Growers, Inc.

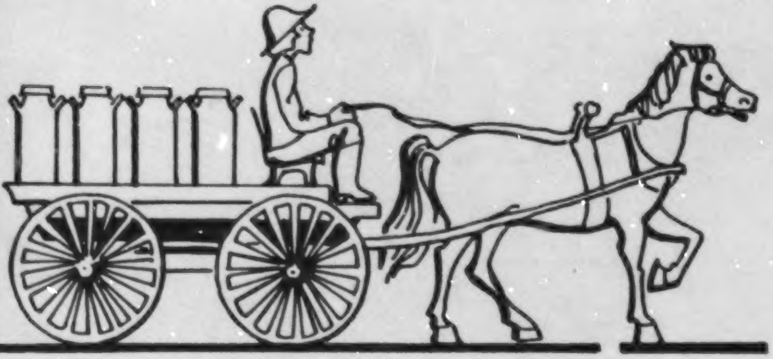
Early cooperatives:

1803 — Miami Exporting Company, first formal farmer cooperative, organized by farmers and merchants to find markets for Ohio farm products.

1863 — Farmers purchasing association organized at Riverhead, N.Y., to buy fertilizer for members.

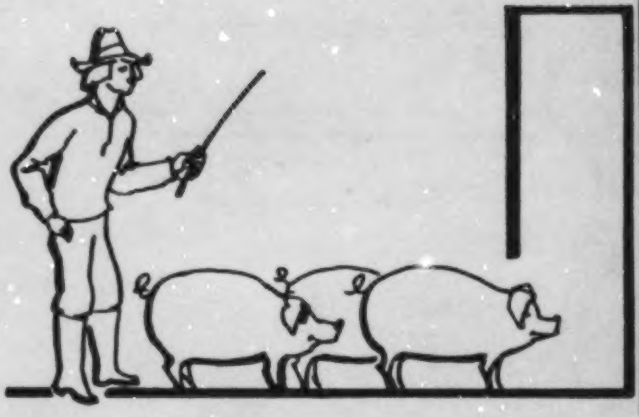
Early cooperatives:

1810



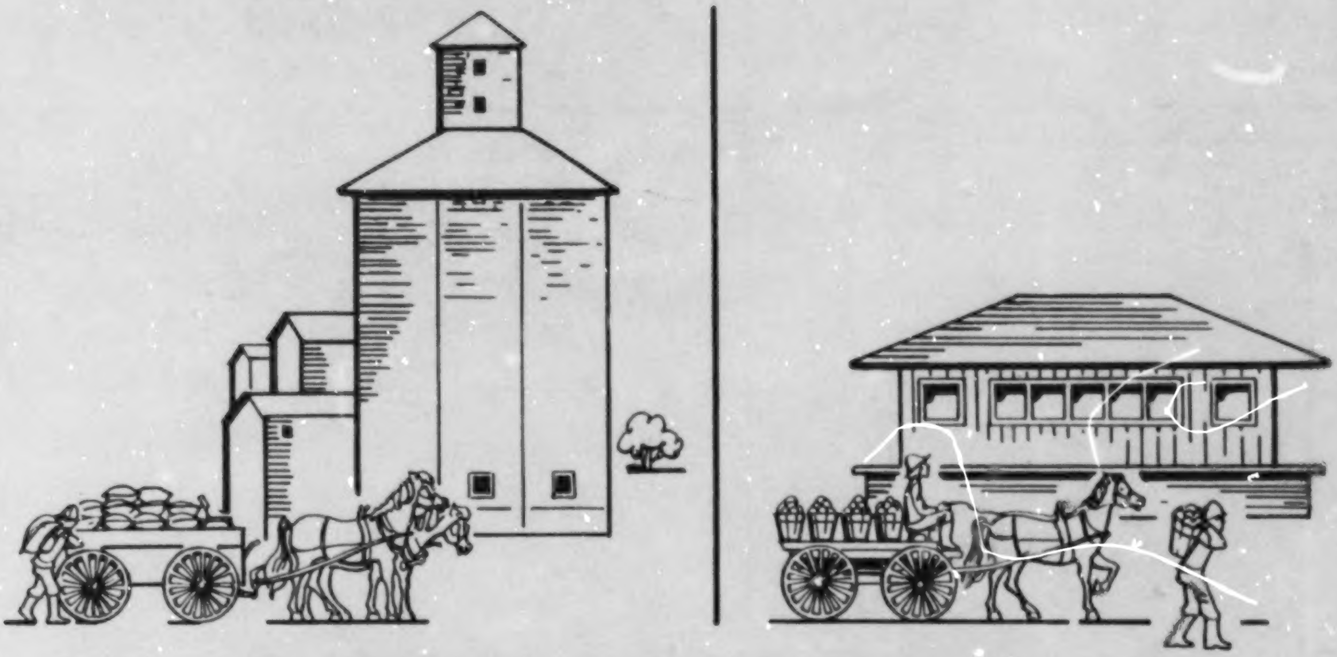
First dairy cooperative at Goshen, Conn.

1820



Licking Exporting Company, Granville, Ohio, first hog marketing, slaughter, and packing cooperative.

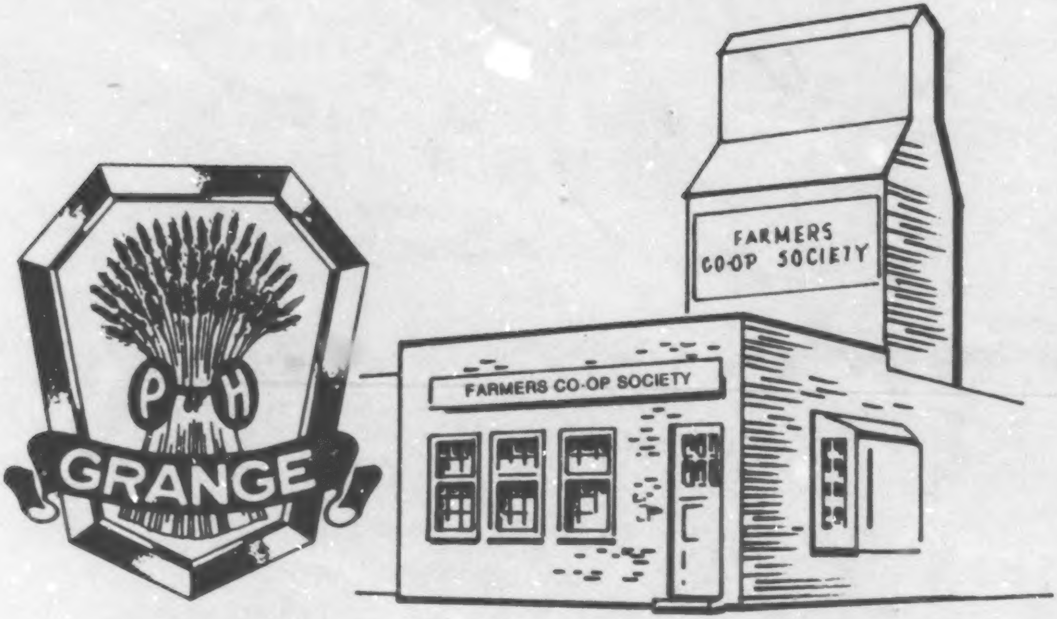
Early cooperatives:



1857 — Grain elevator was organized at Madison, Wis.

1867 — Fruit Growers Union and Cooperative Society, Hammonton, N.J., first fruit marketing cooperative.

1874 — Illinois State Grange made earliest recorded effort to establish a cooperative to market poultry and other farm products.

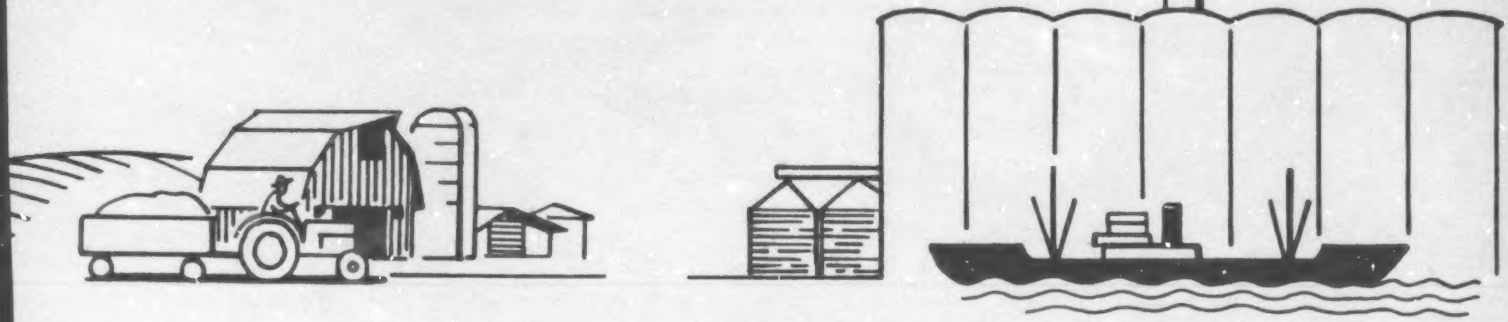

P H
GRANGE
FARMERS CO-OP SOCIETY
FARMERS CO-OP SOCIETY

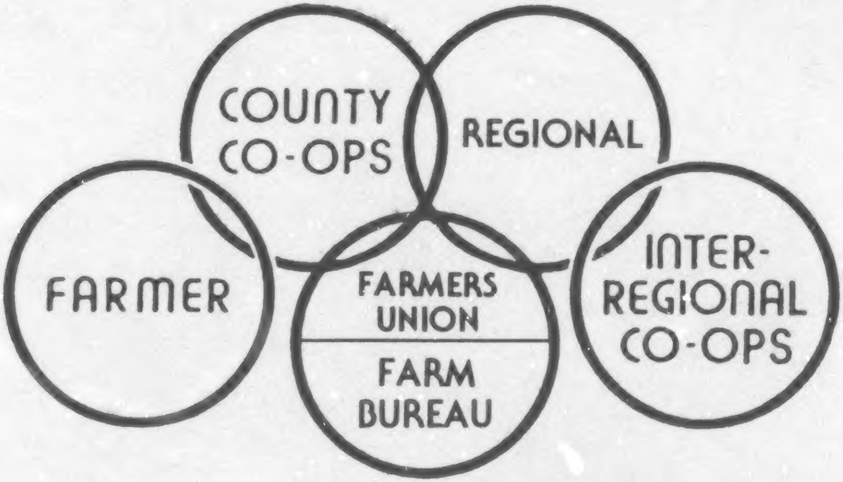
Where did early leadership develop?

National Grange (The Order of Patrons of Husbandry)
American Society of Equity

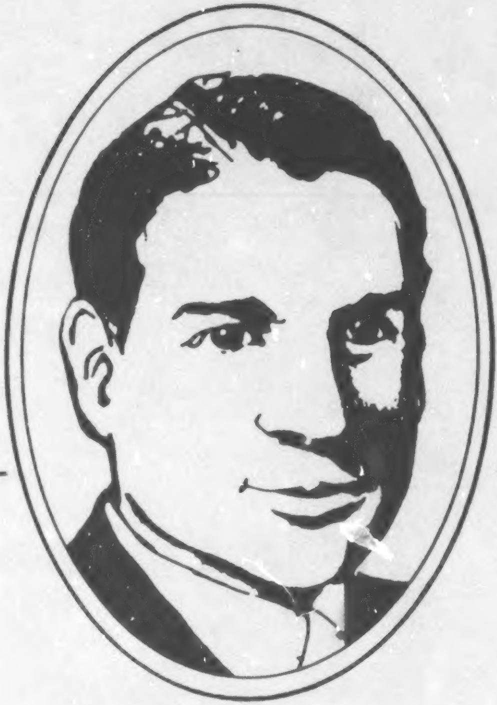
Early leadership:

National Farmers Union
American Farm Bureau Federation




COUNTY CO-OPS
REGIONAL
FARMER
FARMERS UNION
FARM BUREAU
INTER-REGIONAL CO-OPS

What differing schools of thought developed?



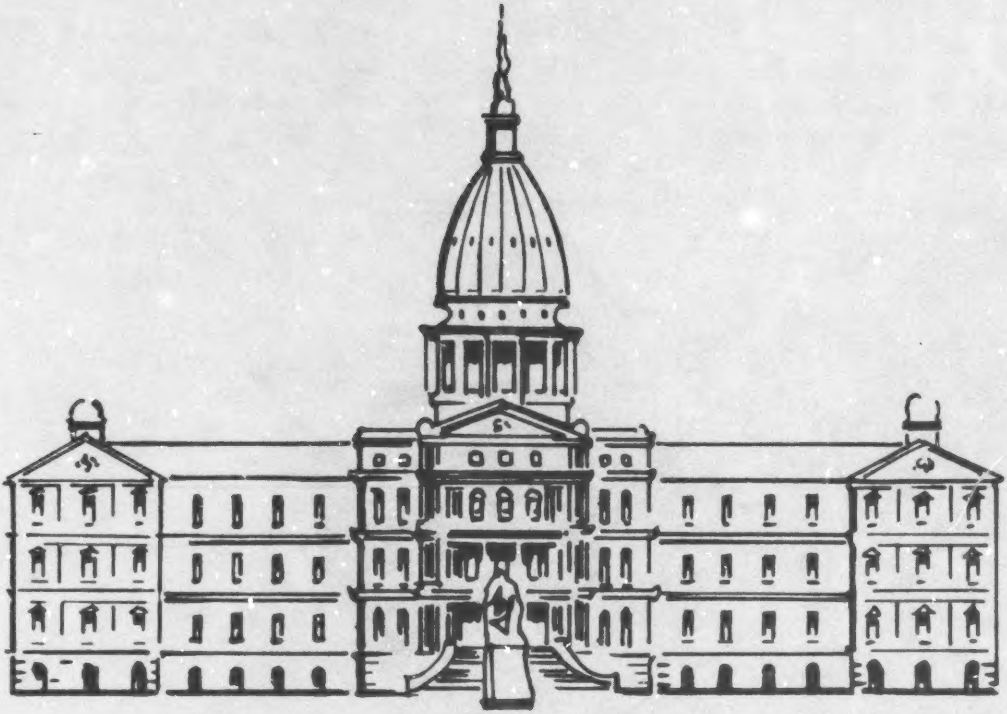
Aaron Sapiro

The Legal Monopoly

Schools of thought:

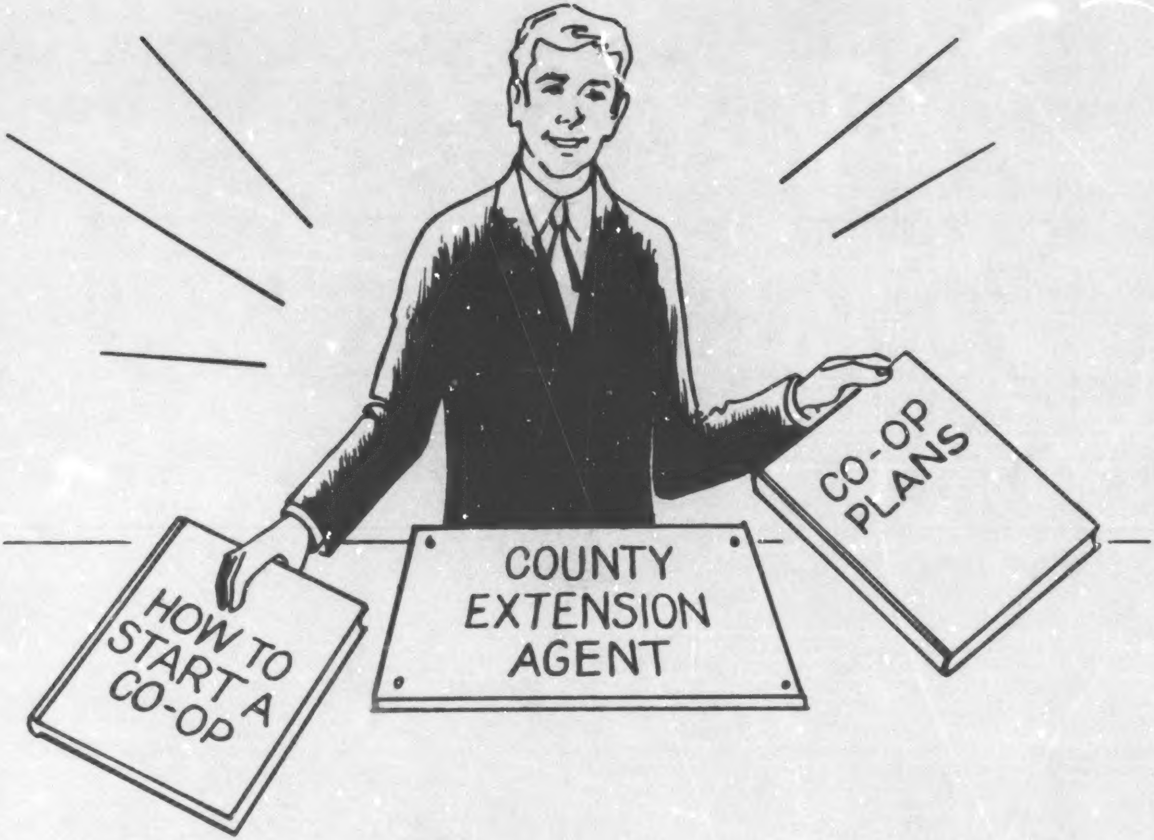
E.G. Nourse:

"The competitive yardstick"



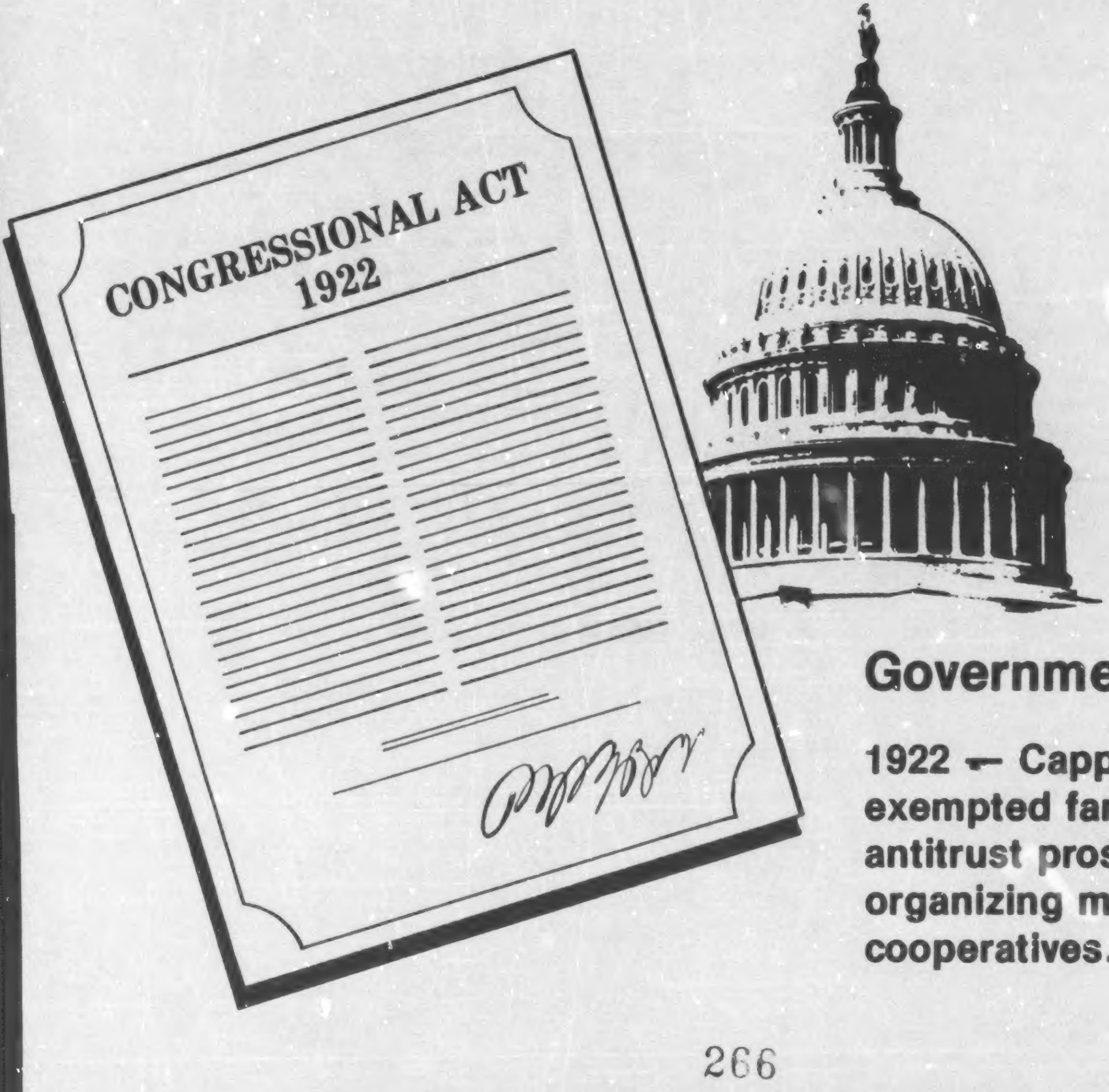
What has been the role of State Government in farmer cooperative development?

1865 — Michigan passed first law recognizing the cooperative method for buying and selling.


HOW TO START A CO-OP
COUNTY EXTENSION AGENT
CO-OP PLANS

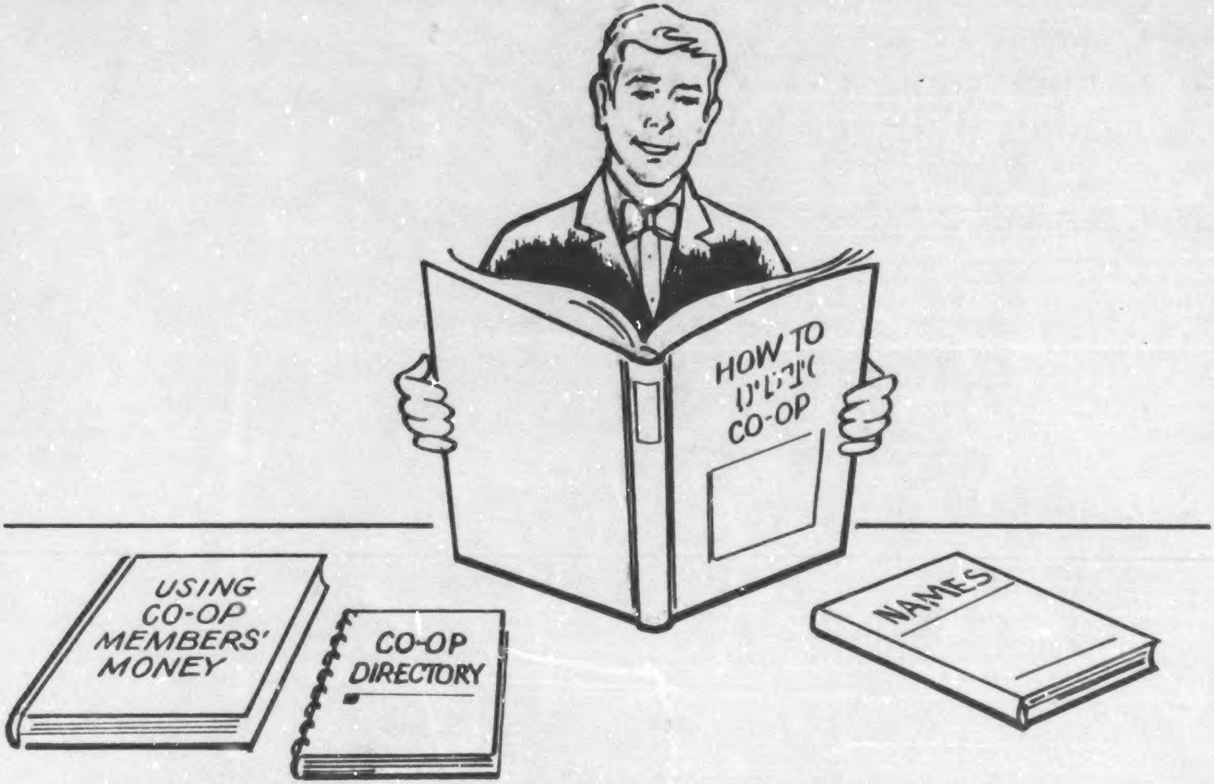
Government role:

1914 — The Smith Lever Act created the Extension Service in the Department of Agriculture and increased educational emphasis on cooperatives.


CONGRESSIONAL ACT
1922

Government role:

1922 — Capper-Volstead Act exempted farmers from antitrust prosecution for organizing marketing cooperatives.

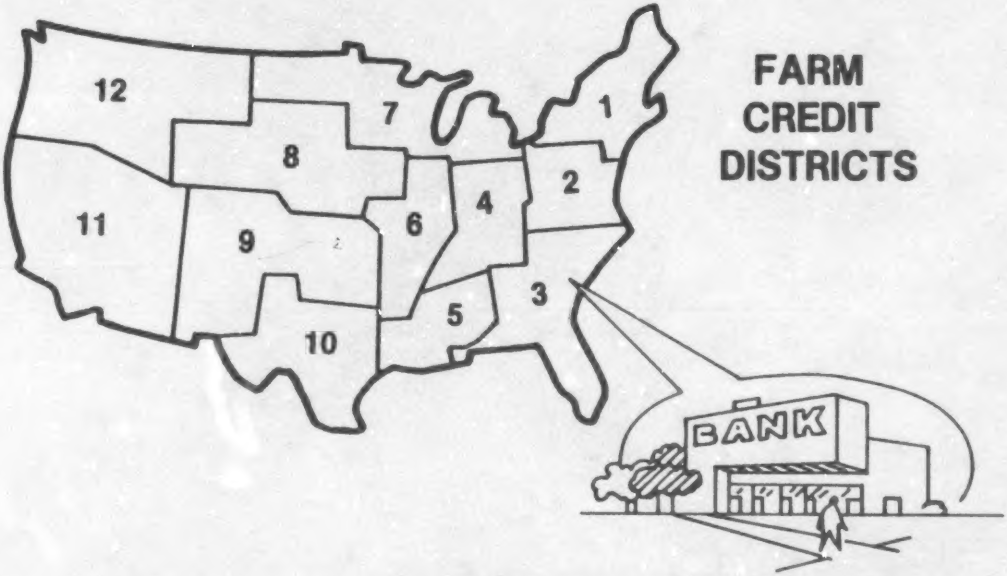

USING CO-OP MEMBERS' MONEY
CO-OP DIRECTORY
HOW TO
CO-OP
NAMES

Government role:

1926 - Cooperative Marketing Act formalized cooperative assistance in the Department of Agriculture by establishing a Division of Cooperative Marketing, now part of Economics, Statistics, and Cooperatives Service.

Federal Government role:

1933 — Farm Credit Act resulted in the development of the Farm Credit System.



FARM CREDIT DISTRICTS

Federal LAND BANK Association

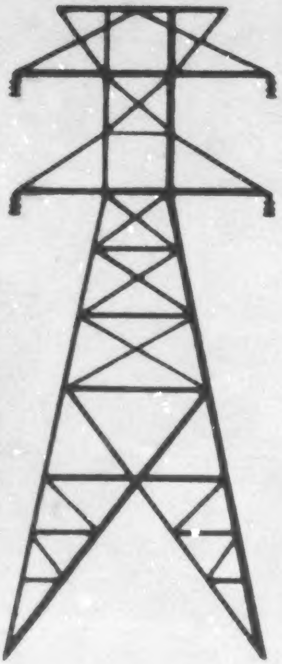
Long term
Farm Credit
1916

Production Credit Association

Short and Intermediate term
Farm Credit
1923

Bank for Cooperatives

Financing for
Farmer Cooperatives
1933



Government role:

1935 — Rural Electrification Act provided financial assistance to rural electric and telephone cooperatives.

What national organizations serve farmer cooperatives?

American Institute of Cooperation — information and educational assistance.

Cooperative League of the USA — educational and consumer assistance.

National Council of Farmer Cooperatives — legislative assistance.

nmpf

RE

CU

acdi

National organizations:

National Milk Producers Federation — legislative assistance

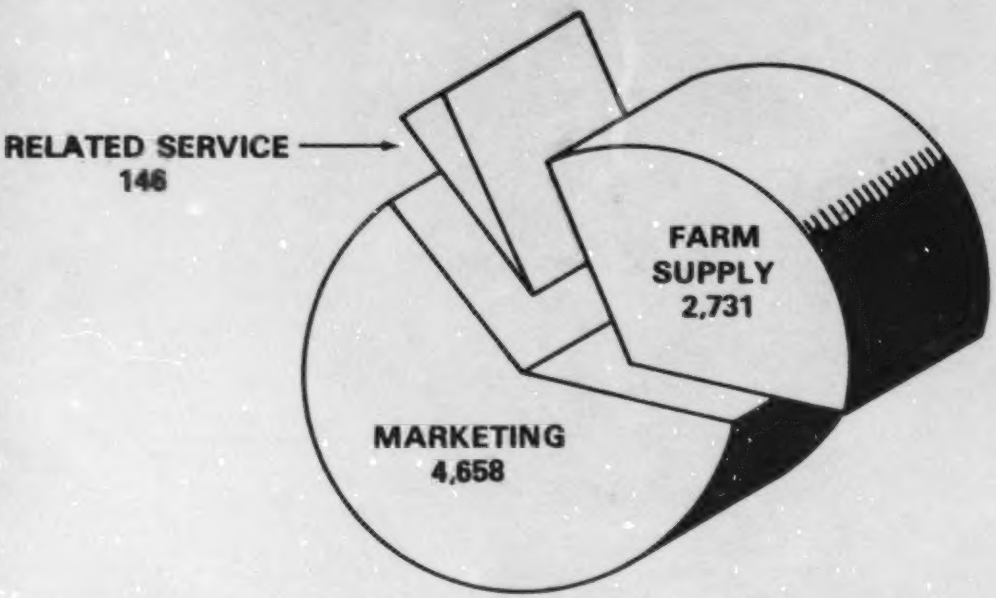
National Rural Electric Cooperative Association — legislative assistance

Credit Union National Association

Agricultural Cooperative Development International

State Cooperative Organizations

NUMBER OF COOPERATIVES
1976



What is the extent of present farmer cooperative activity in the U.S.?

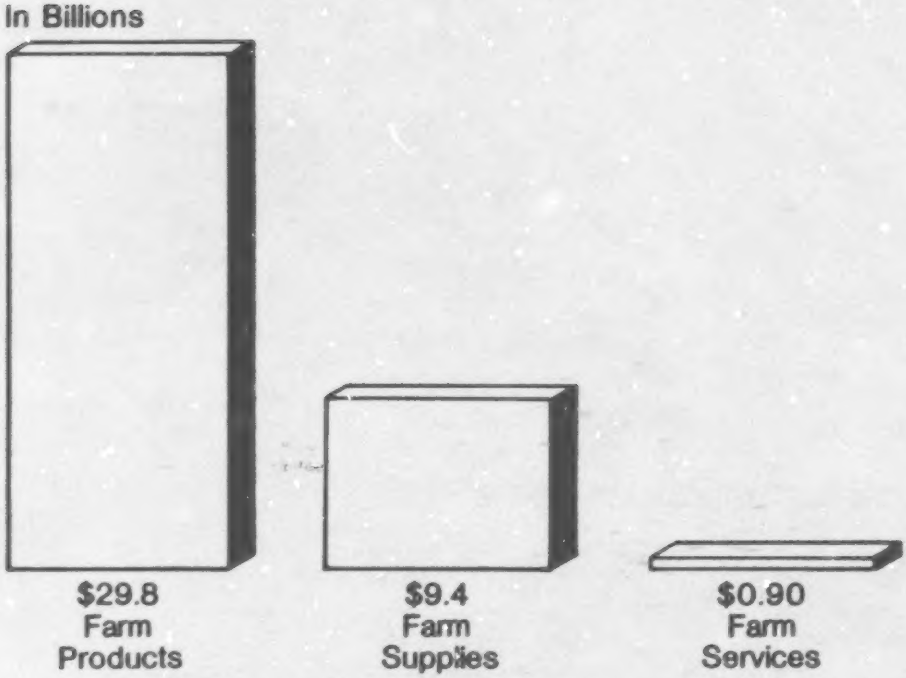
—5 out of 6 farmers are members of at least one cooperative

—cooperative memberships total 5.9 million

—7,535 different cooperatives are in operation

COOPERATIVE BUSINESS VOLUME
1976

NET BUSINESS
Excludes intercooperative business



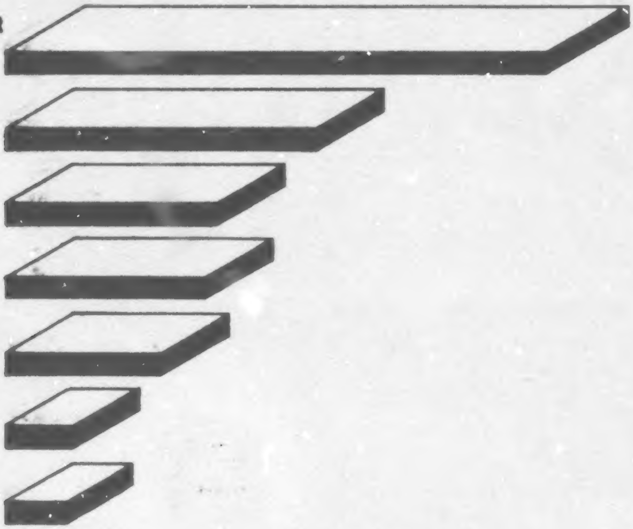
What is the extent of farmer cooperative business activity in the U.S.?

—combined annual net volume exceeds $40 billion.

COOPERATIVES' COMBINED MARKET SHARE AT THE FARM LEVEL

1976

Number of Cooperatives Handling		Market Share Percent
579	Dairy products	74
2,599	Grain & soybeans	40
436	Fruits & vegetables	27
519	Cotton & cotton products	26
214	Other	20
654	Livestock & livestock products	9
151	Poultry products	8



Based on net marketing business of $ 25.8 billion

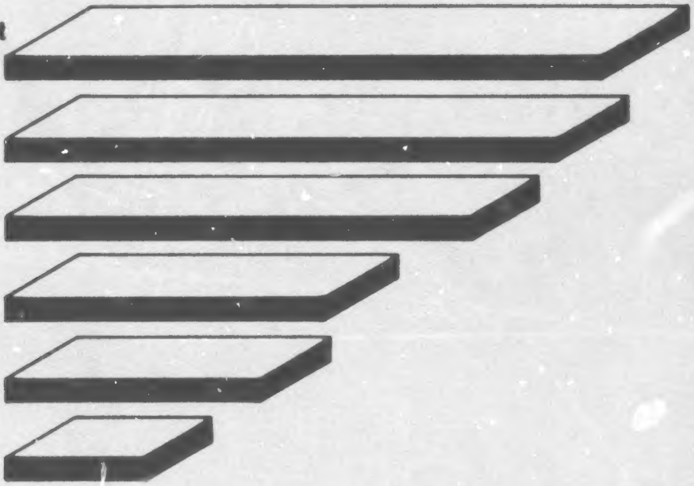
What is the extent of present farmer cooperative activity in the United States?

—farmers market 29 percent of their products through their own cooperatives

COOPERATIVES' COMBINED MARKET SHARE AT THE FARM LEVEL

1976

Number of Cooperatives Handling		Market Share Percent
3,949	Fertilizer & lime	36
3,597	Farm chemicals	33
2,983	Petroleum	28
3,819	Feed	19
3,526	Seed	15
4,432	Other supplies & equipment	8



Based on net farm supply business of $8.7 billion

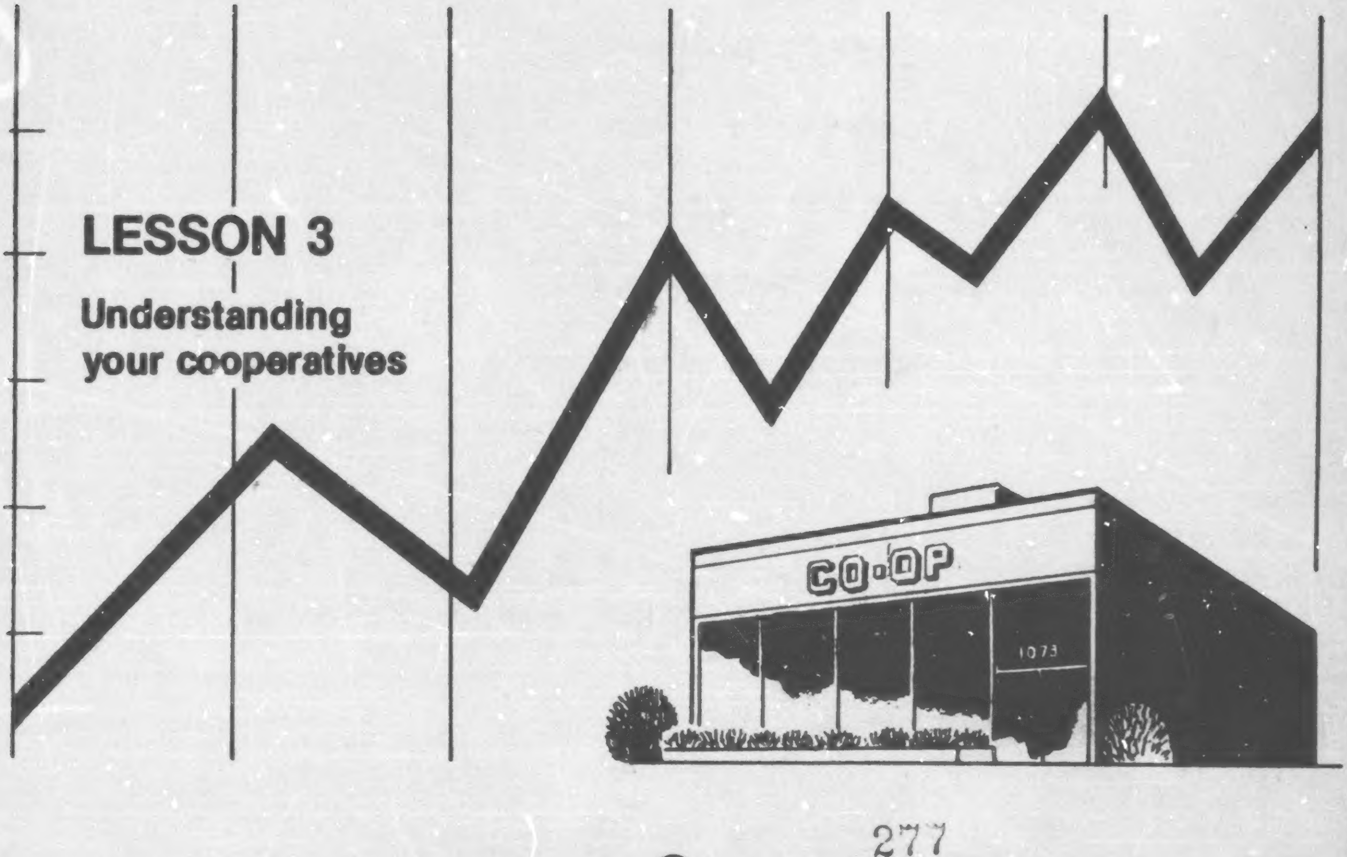
What is the extent of present farmer cooperative activity in the United States?

—farmers purchase 18 percent of their production supplies through their own cooperatives

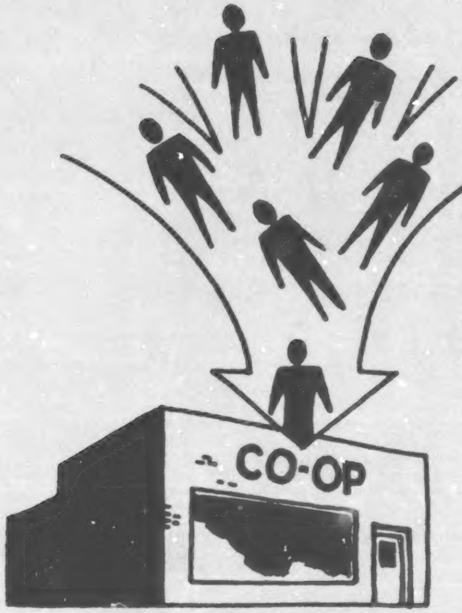
ECONOMIC DEMOCRACY IN ACTION

LESSON 3

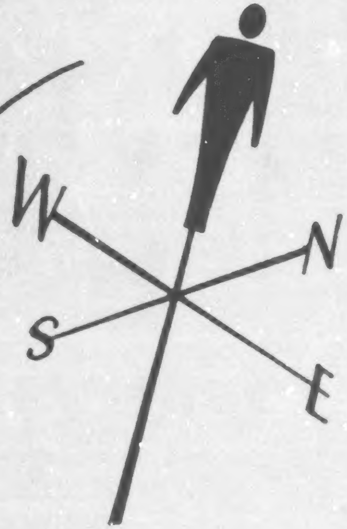
Understanding your cooperatives



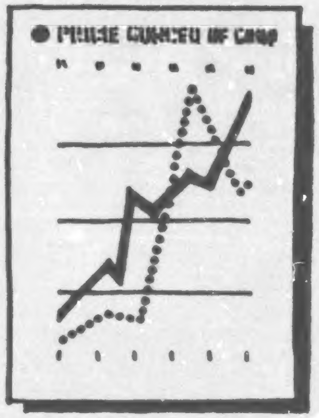
HOW DO YOU ORGANIZE A COOPERATIVE?



INTERESTED LEADERS MEET



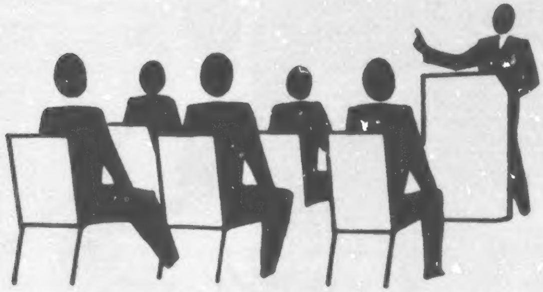
MEMBERSHIP POTENTIAL DETERMINED



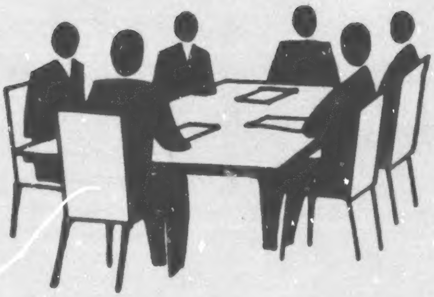
ECONOMIC FEASIBILITY STUDY CONDUCTED

NECESSARY LEGAL PAPERS FILED

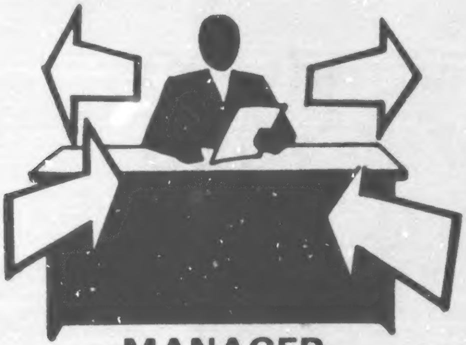
WHO ARE THE KEY PEOPLE IN A COOPERATIVE?



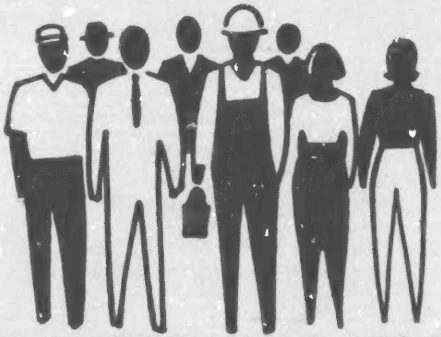
MEMBERS



BOARD OF DIRECTORS

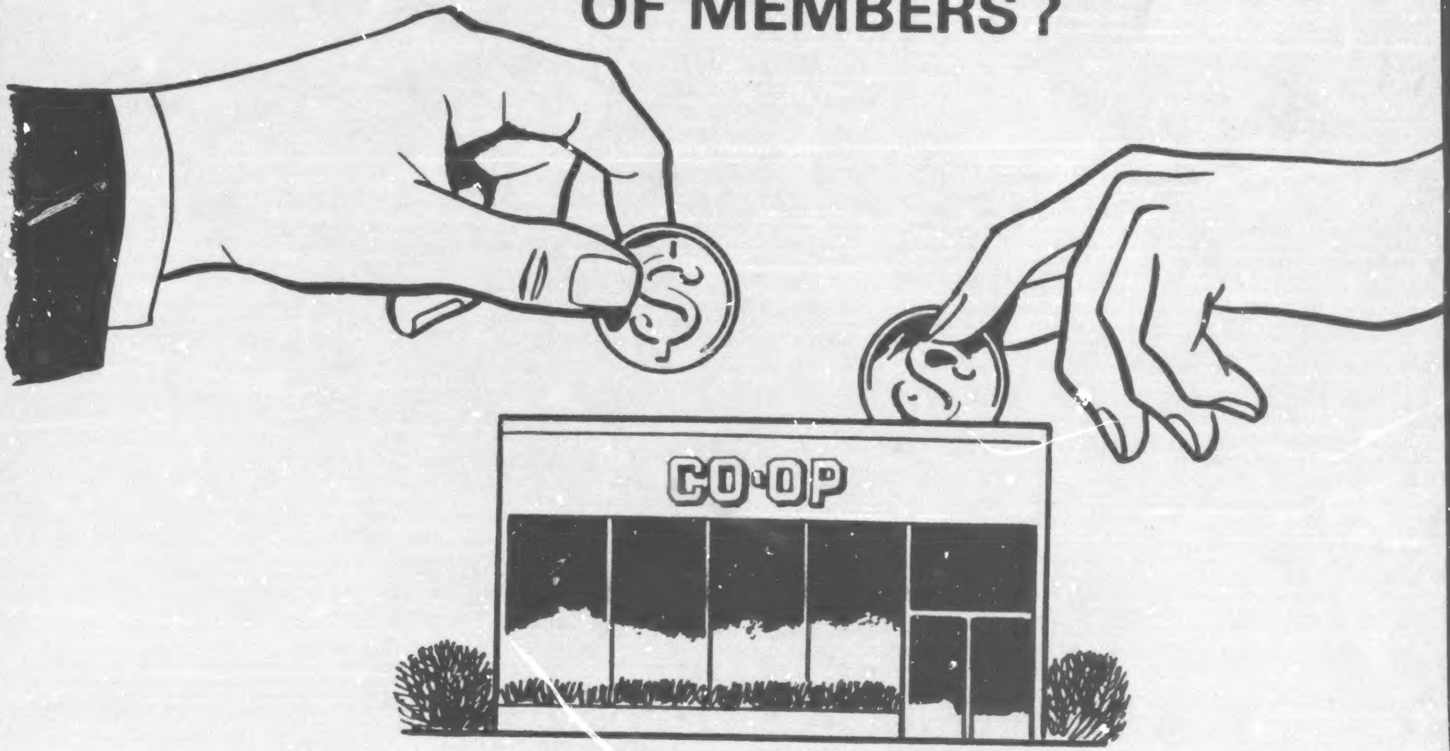


MANAGER



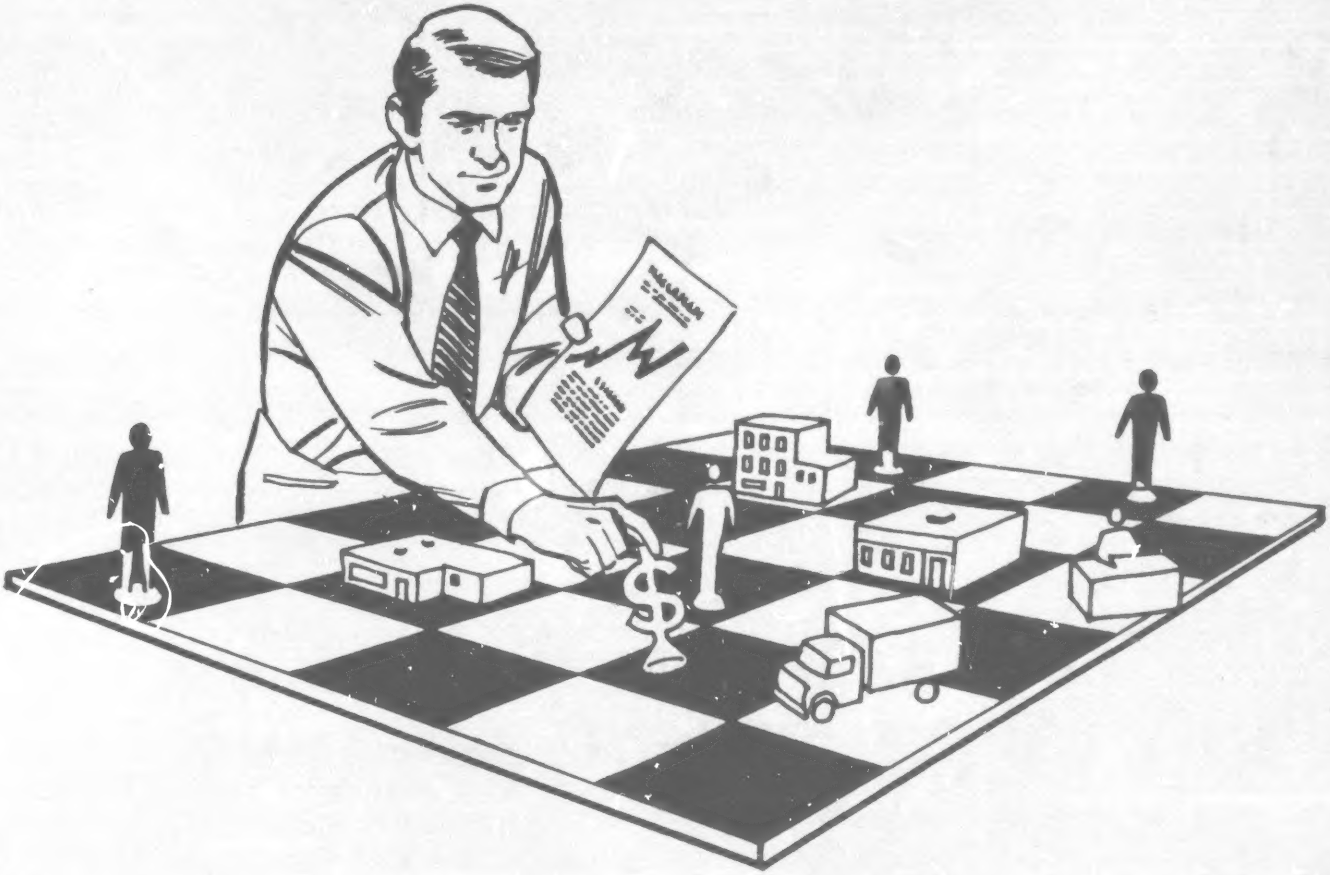
EMPLOYEE WORK FORCE

WHAT ARE THE RESPONSIBILITIES OF MEMBERS ?



. . . Provide Financing

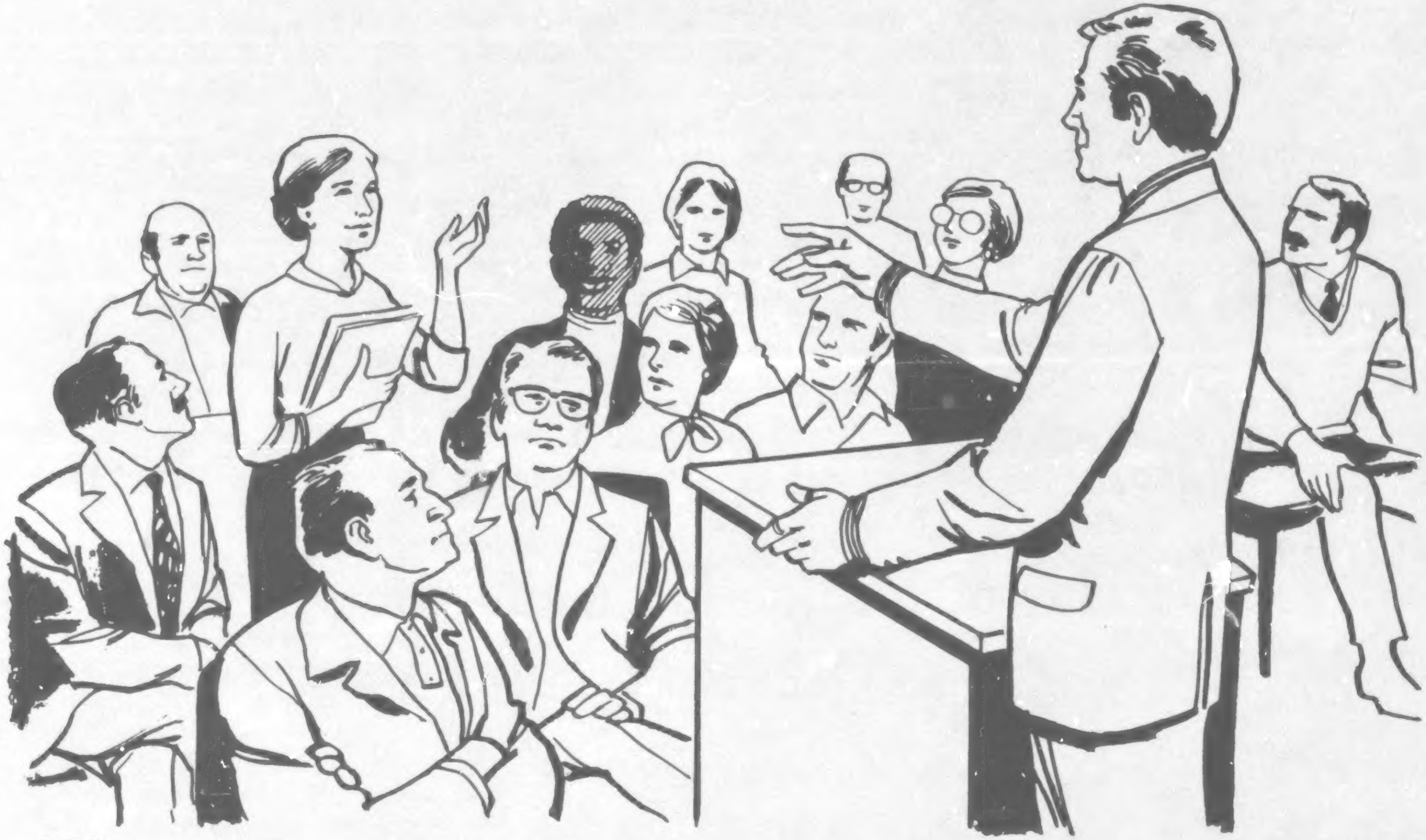
MEMBER RESPONSIBILITY



. . . Provide Management

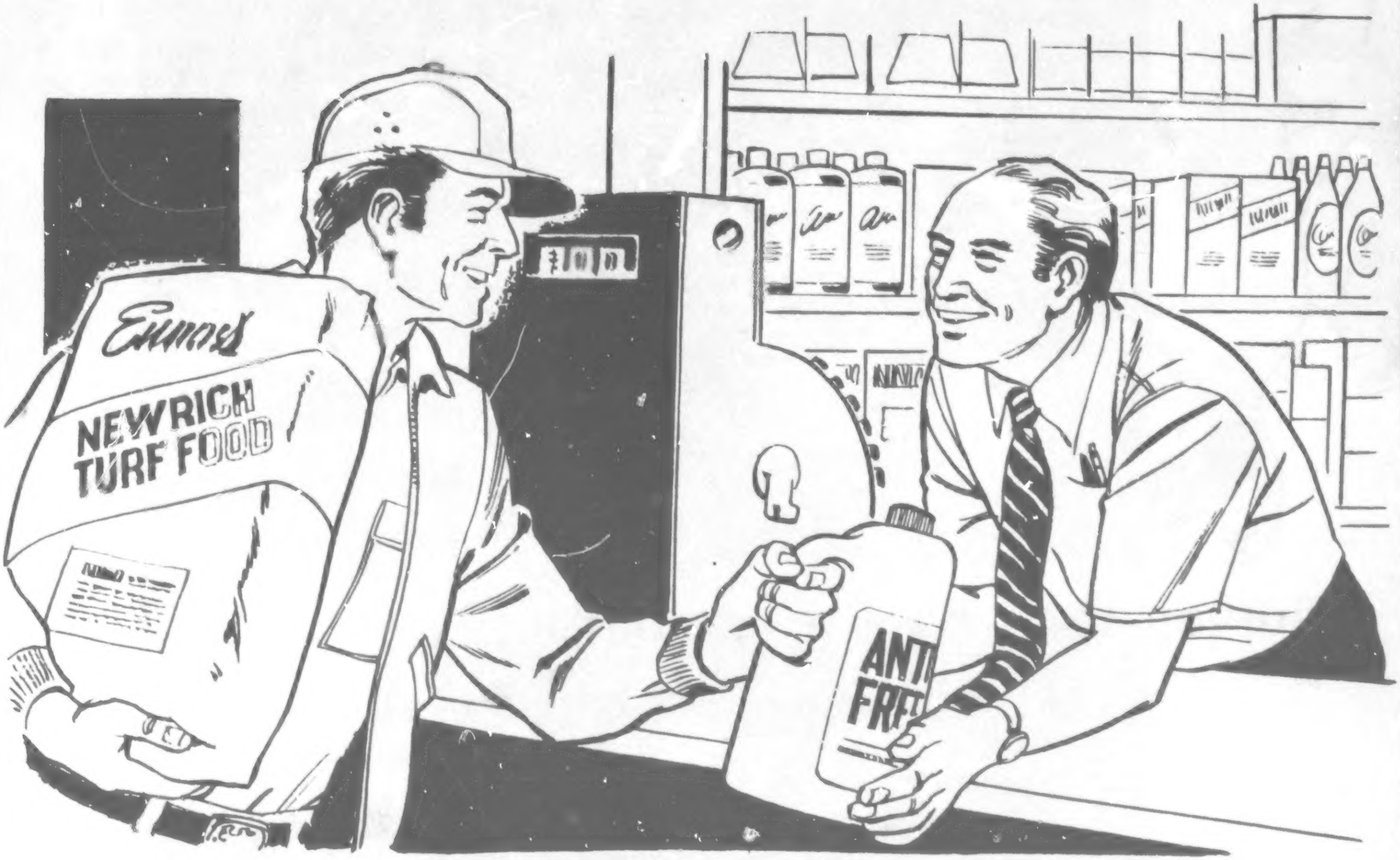
3-5

MEMBER RESPONSIBILITY
. . . Participate in Decision Making



MEMBER RESPONSIBILITY

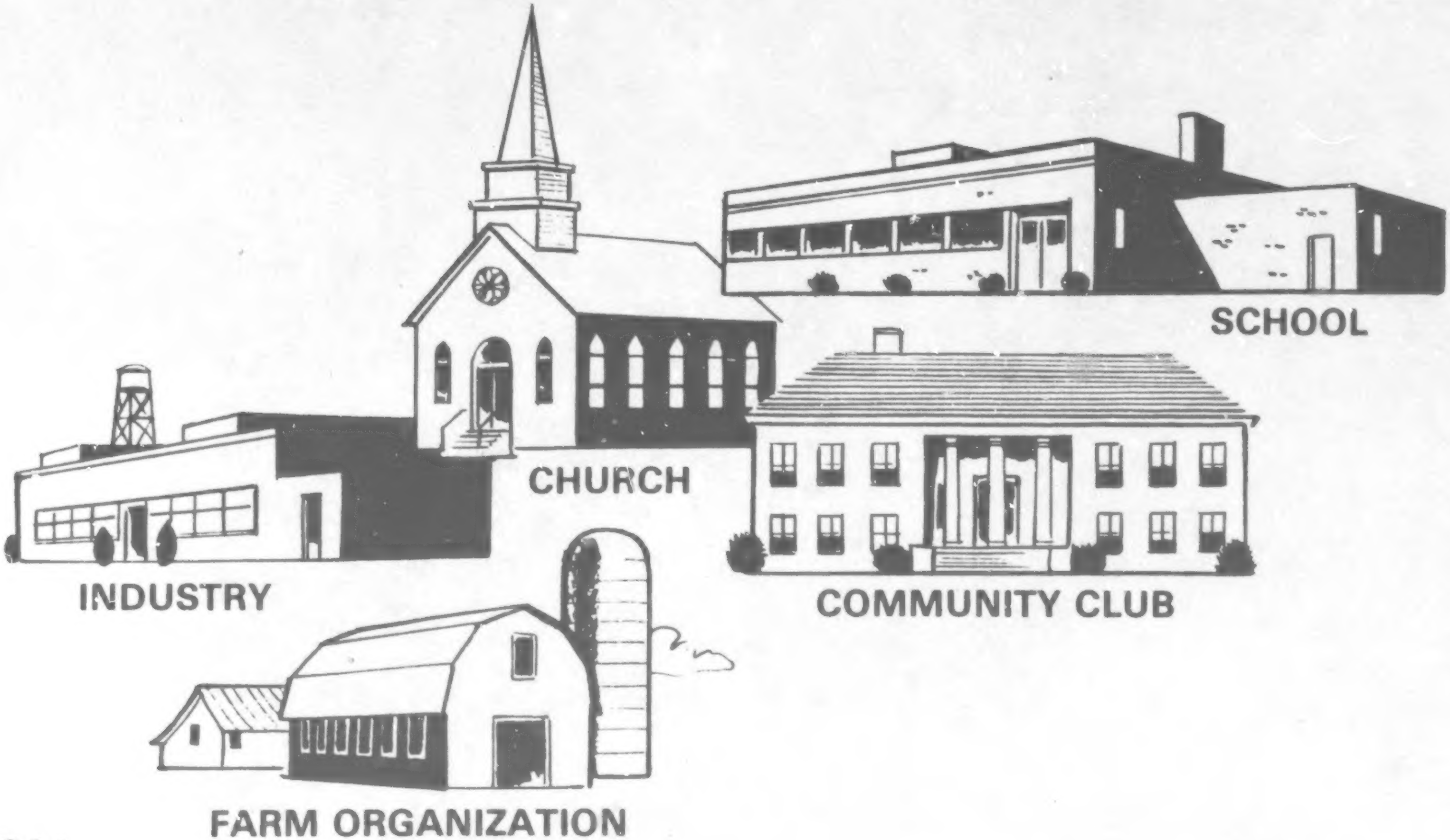
. . . give maximum patronage support


Emmons
NEWRICH
TURF FOOD
ANTI
FRE

3-7

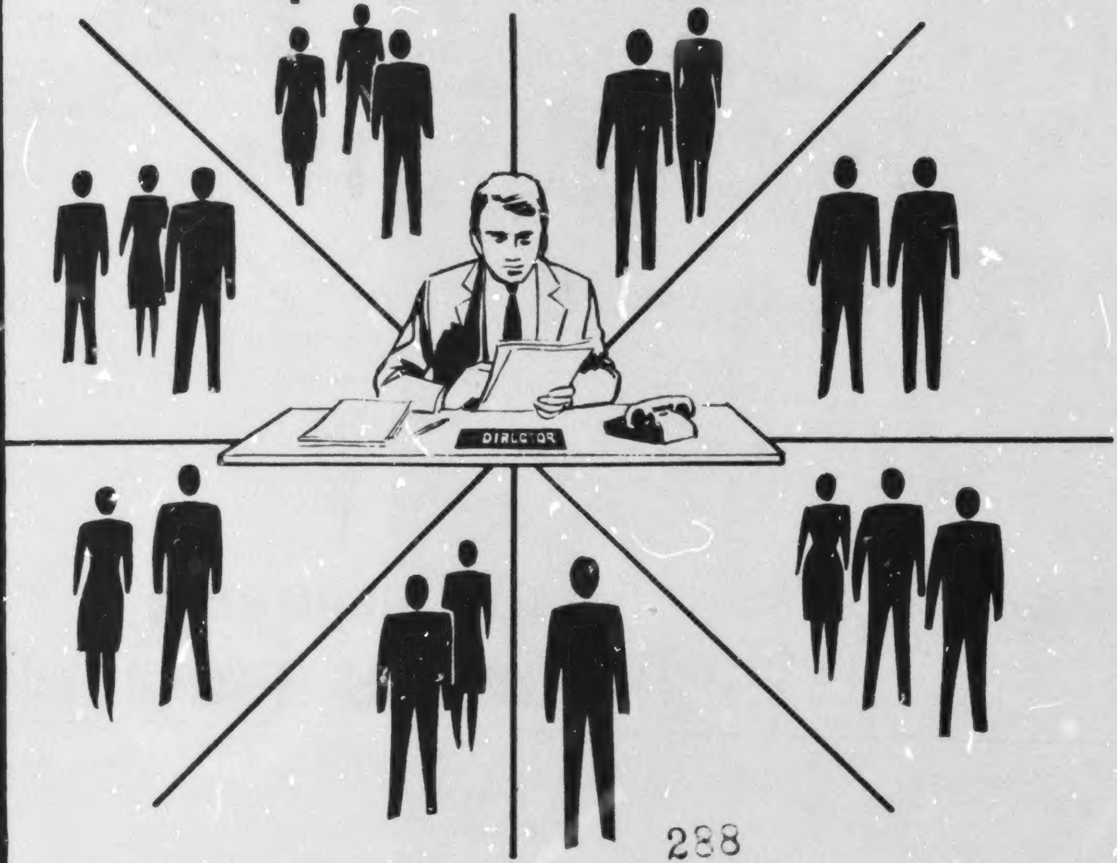
MEMBER RESPONSIBILITY

. . . Establish Community Involvement


SCHOOL
CHURCH
INDUSTRY
COMMUNITY CLUB
FARM ORGANIZATION

WHAT ARE RESPONSIBILITIES OF DIRECTORS?

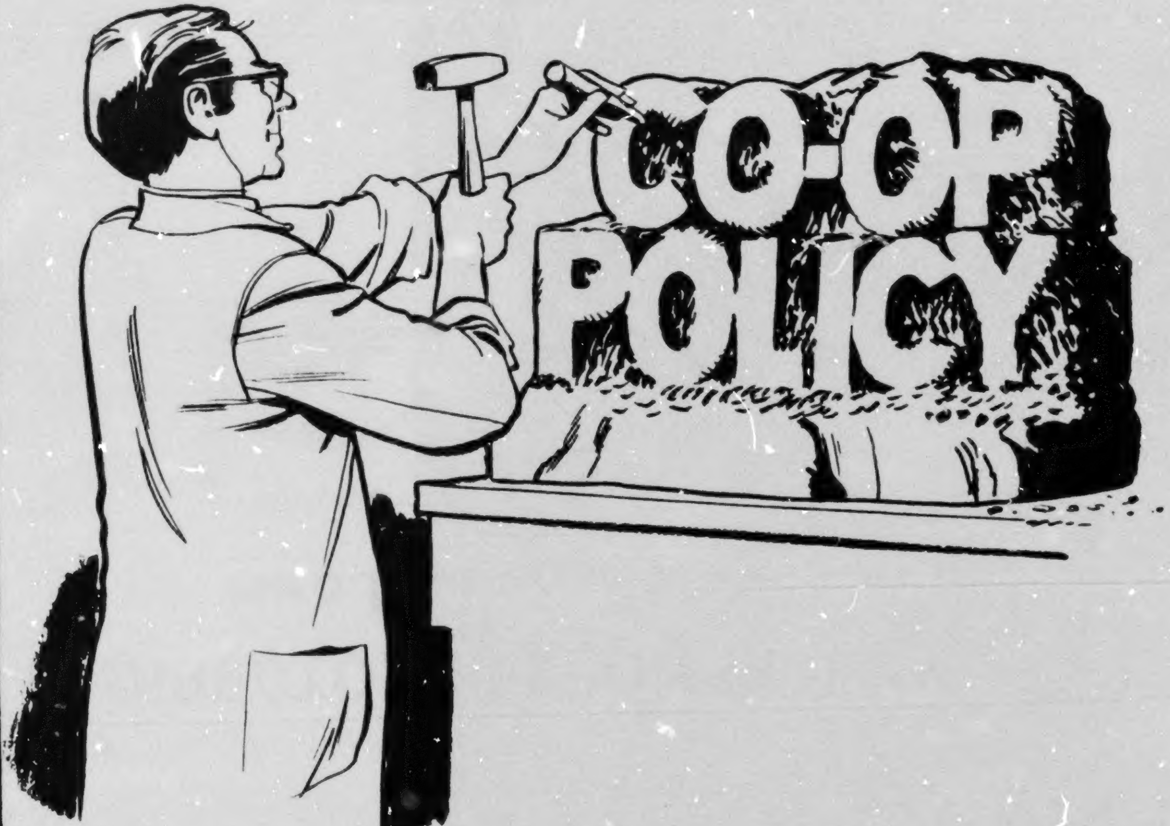
. . . Represent Members



Ag IV - V - 140

DIRECTOR RESPONSIBILITY

. . . Formulate Policy

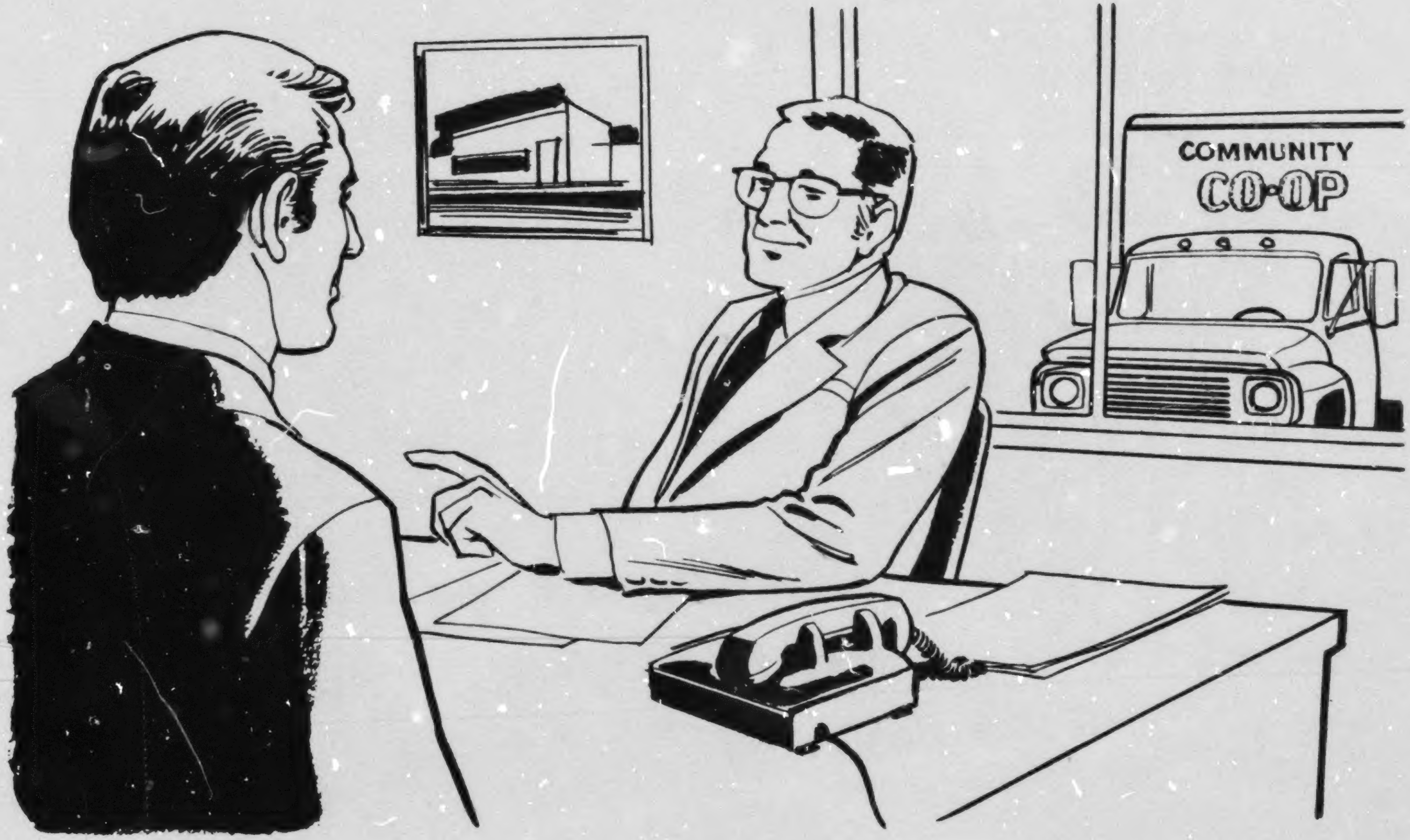

CO-OP
POLICY

Ag IV - V - 141

DIRECTOR RESPONSIBILITY

. . . Hire Managerial Personnel

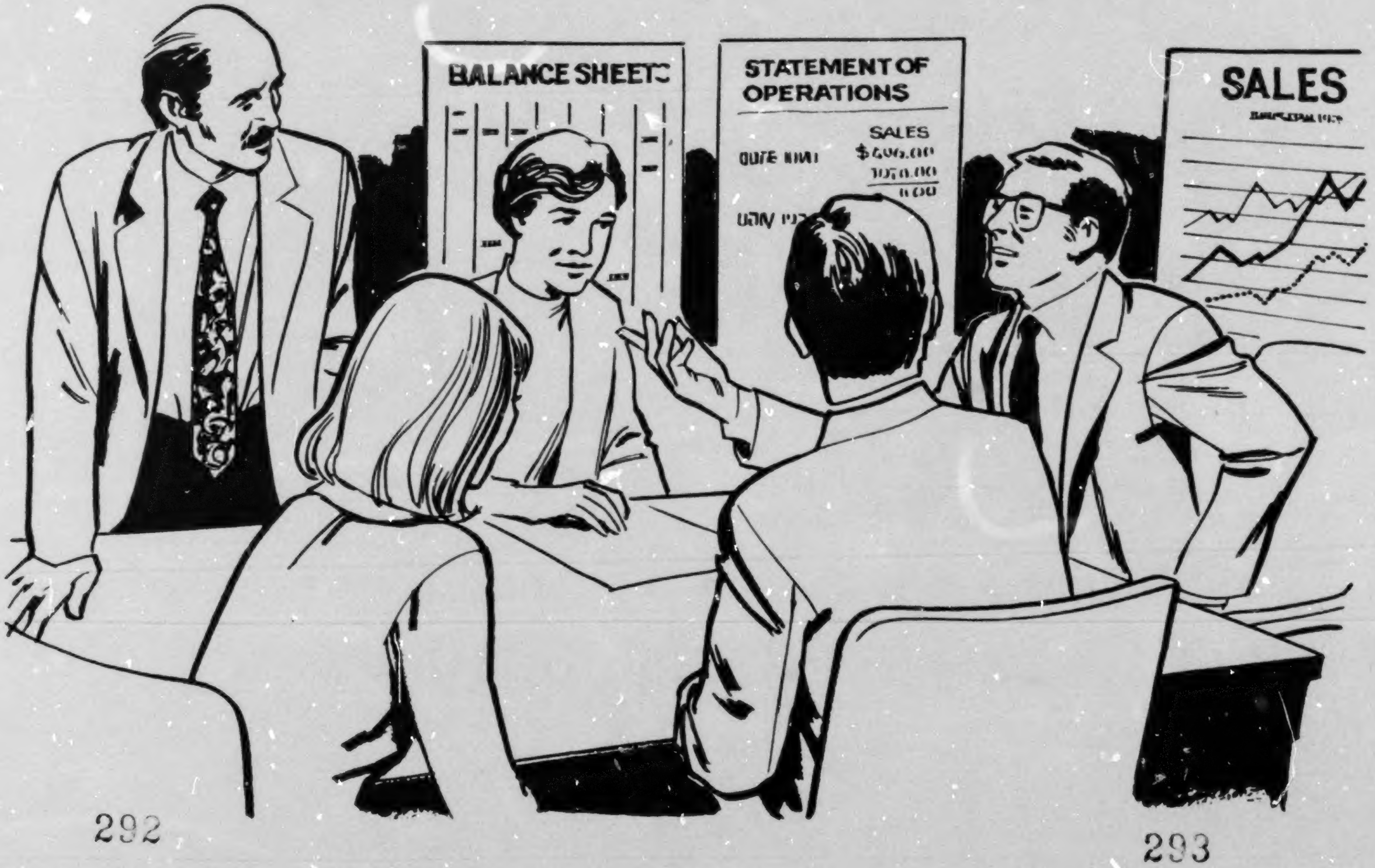
Ag IV - V - 142


COMMUNITY
CO-OP

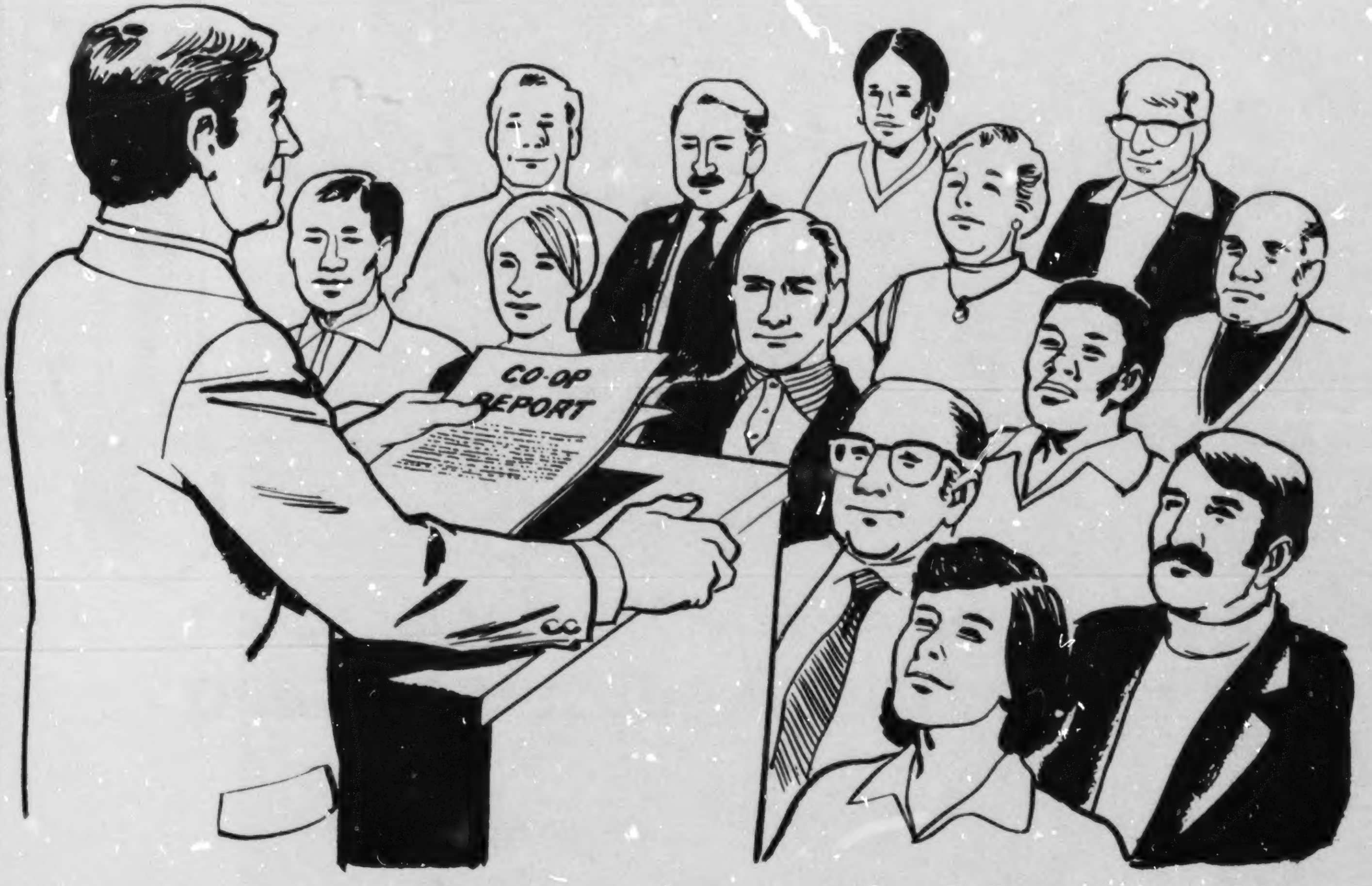
3-10

DIRECTOR RESPONSIBILITY

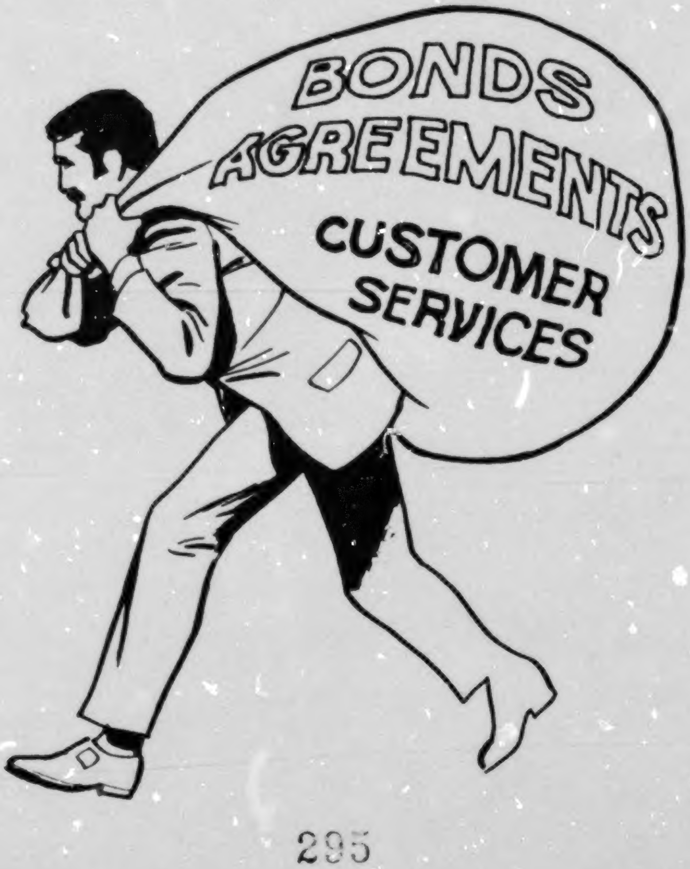
. . . Evaluate Cooperative Performance


BALANCE SHEETS
STATEMENT OF OPERATIONS
SALES
SALES

DIRECTOR RESPONSIBILITY
. . . Report To Member-Owners

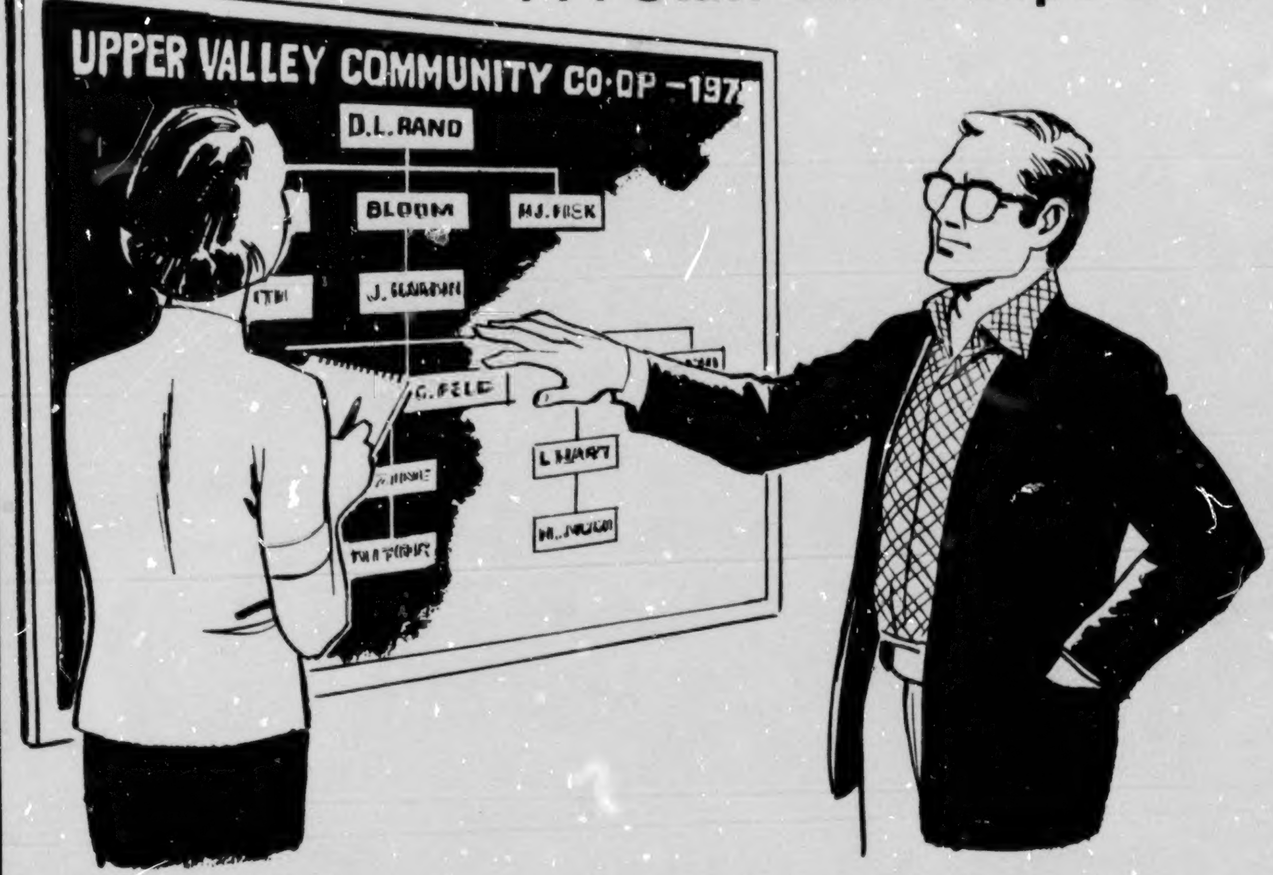

CO-OP
REPORT

DIRECTOR RESPONSIBILITY
. . . Assume Liability For Cooperative's Operations And Actions


BONDS
AGREEMENTS
CUSTOMER SERVICES

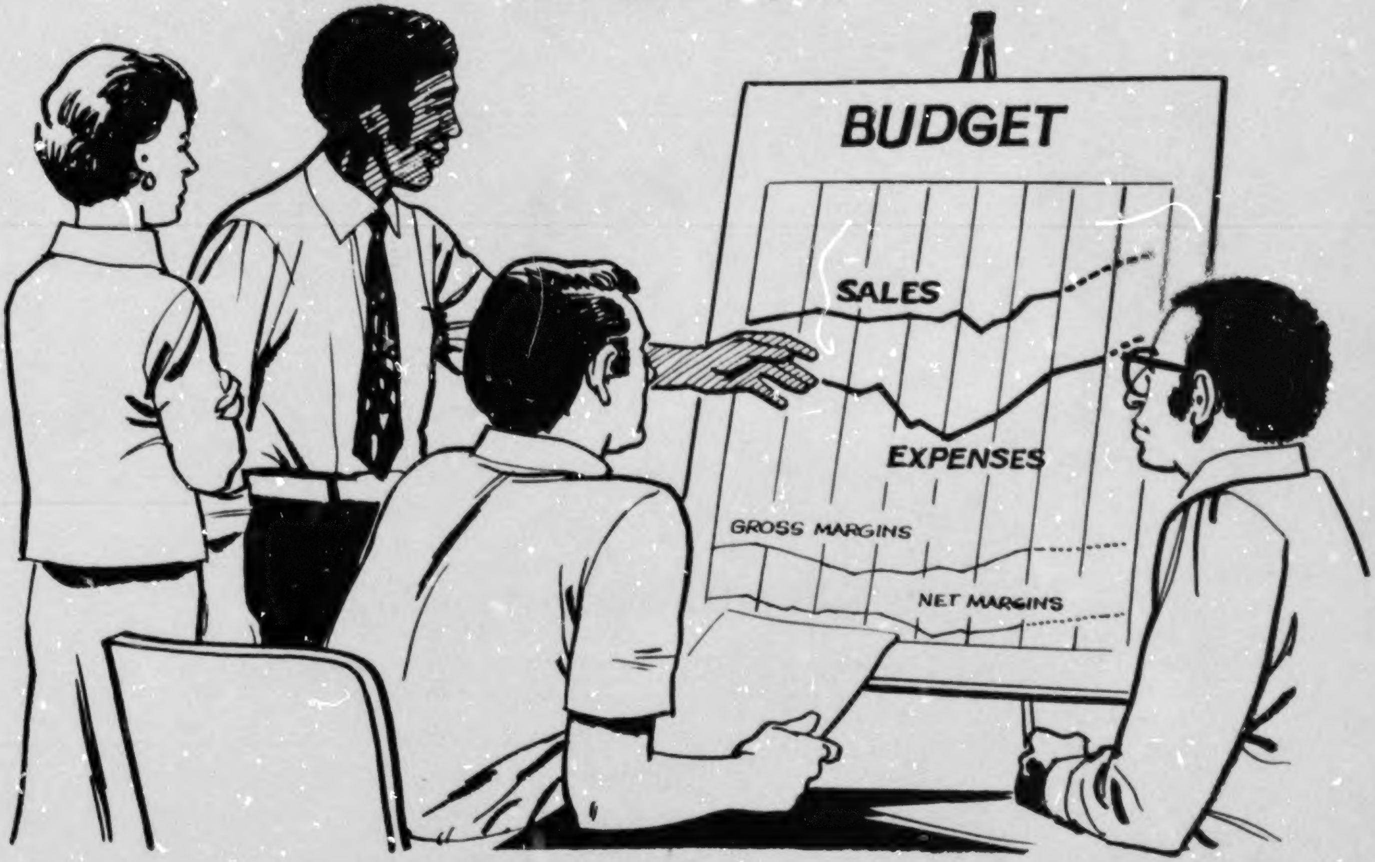
WHAT ARE THE MANAGER'S RESPONSIBILITIES?

. . . Staff The Cooperative


UPPER VALLEY COMMUNITY CO·OP –197
D.L. RAND
BLOOM
M.J. FISK
C. FELD
L. HART

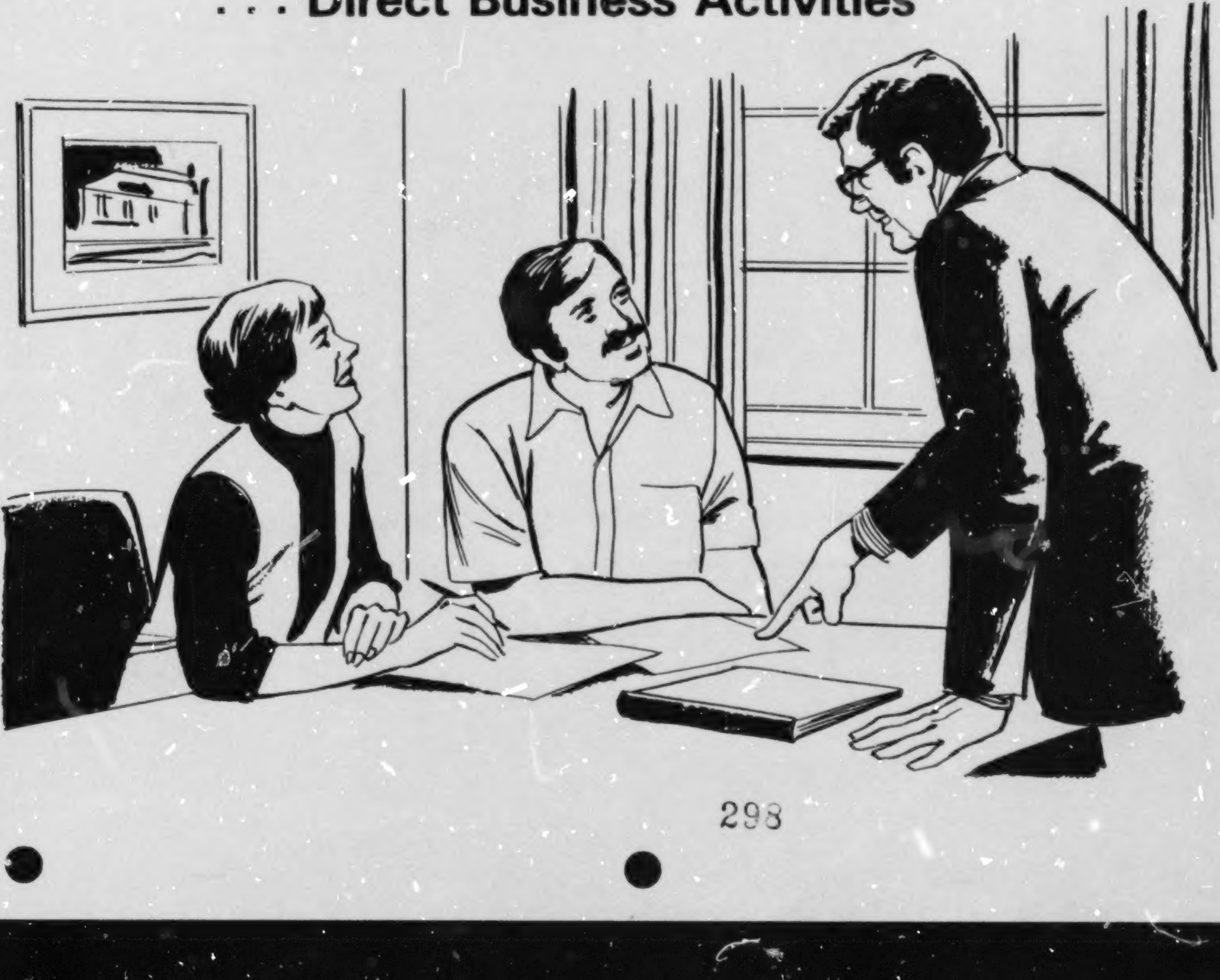
MANAGER RESPONSIBILITY

. . . Develop Goals and Plans to Reach Objectives Set by the Board

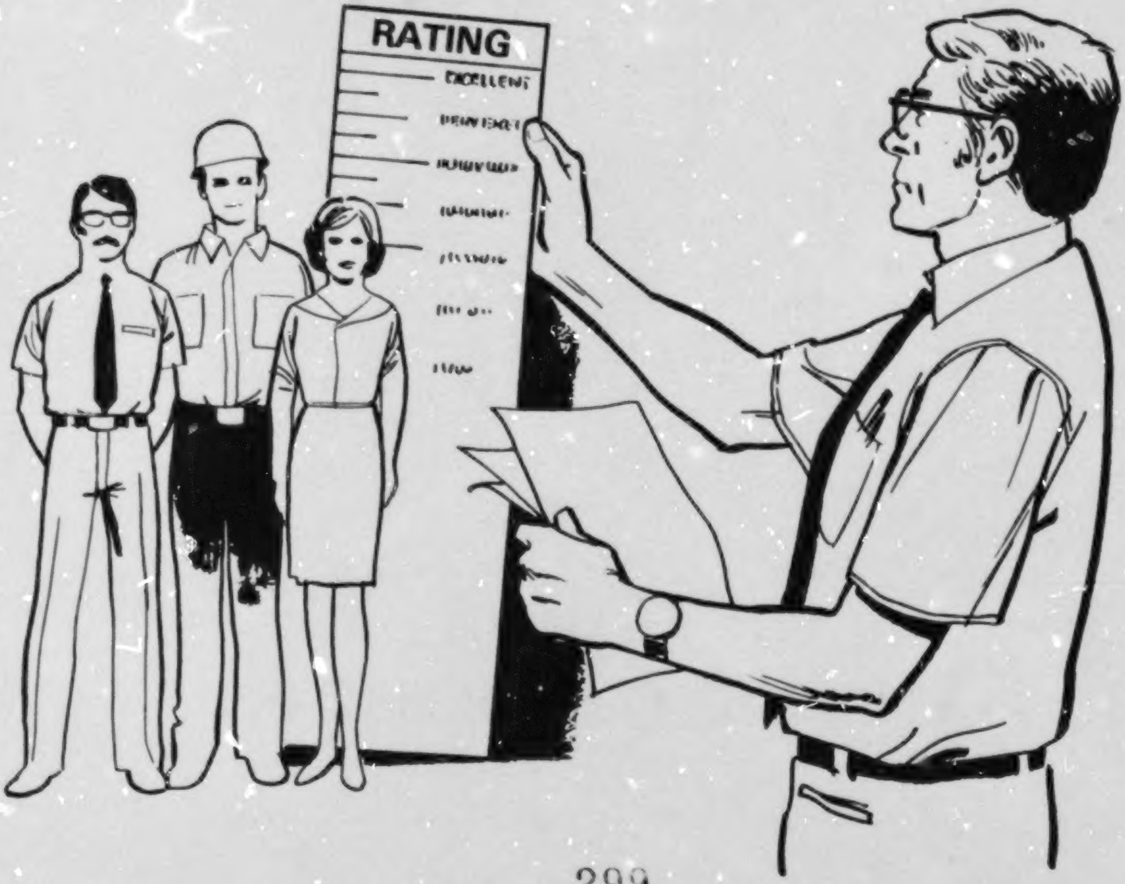

BUDGET
SALES
EXPENSES
GROSS MARGINS
NET MARGINS

MANAGER RESPONSIBILITIES

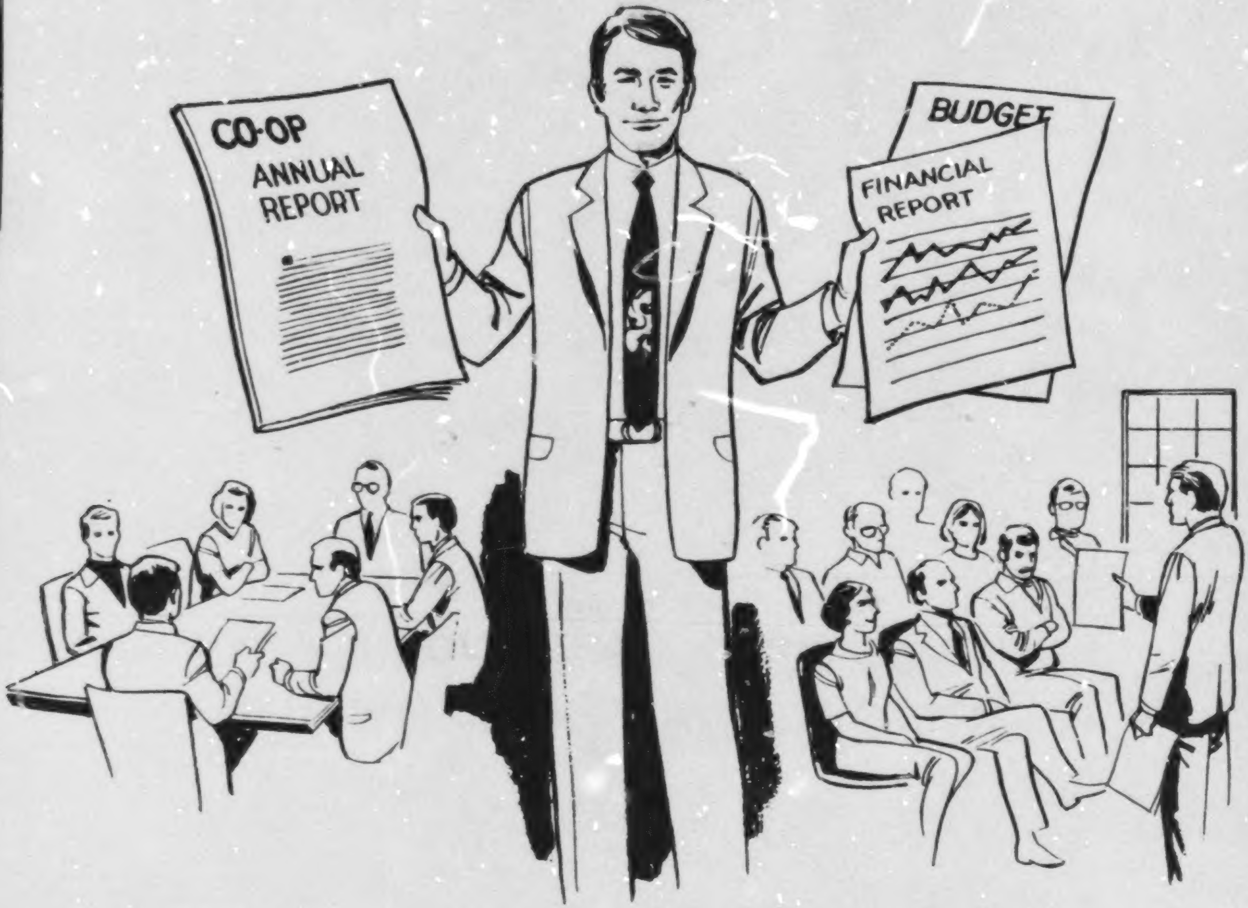
. . . Direct Business Activities



MANAGER RESPONSIBILITY
. . . Performance Evaluation


RATING
EXCELLENT

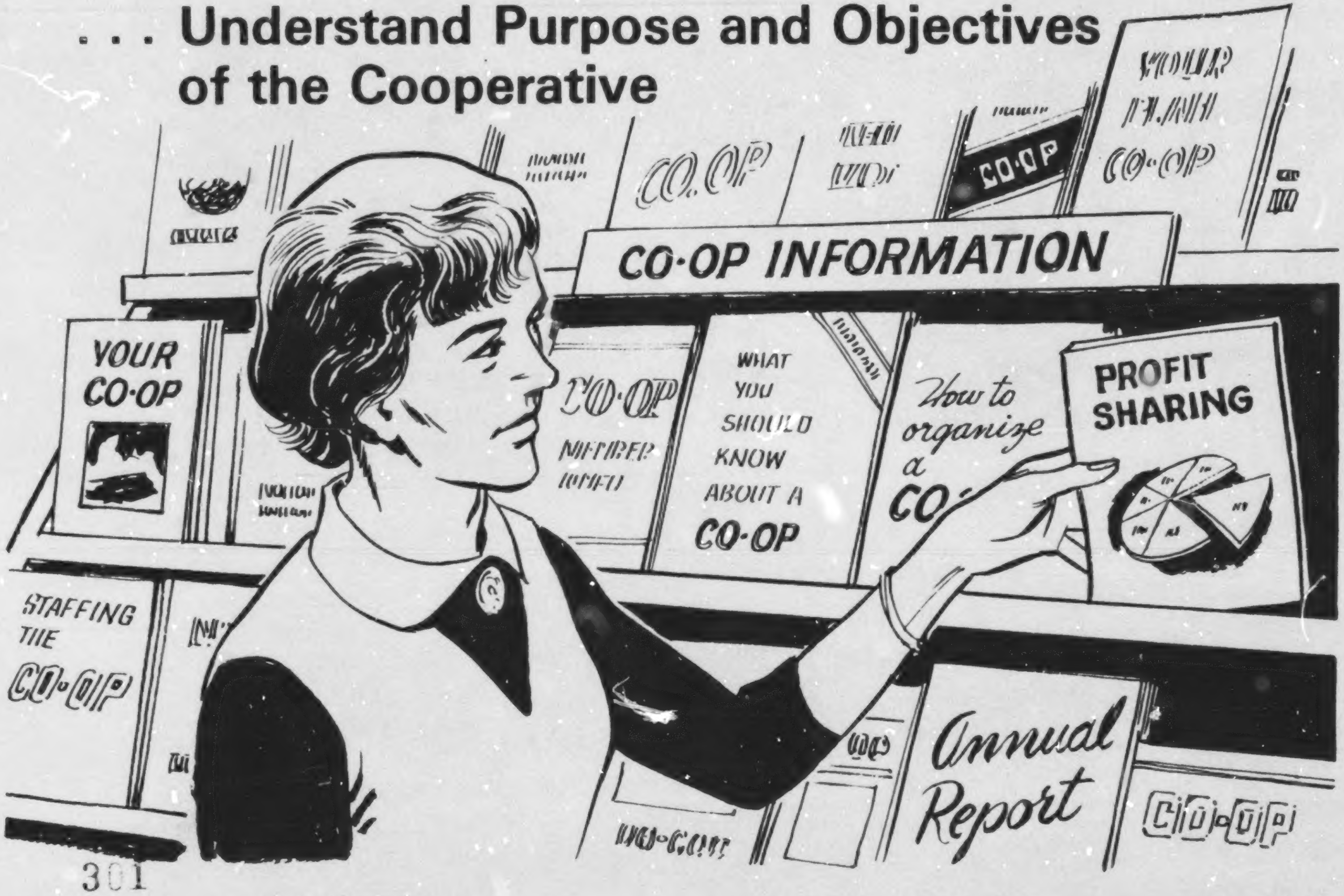
MANAGER RESPONSIBILITY
. . . Report to Board and Membership


CO-OP
ANNUAL REPORT
BUDGET
FINANCIAL REPORT

3-19

WHAT ARE EMPLOYEES RESPONSIBILITIES?

. . . Understand Purpose and Objectives of the Cooperative

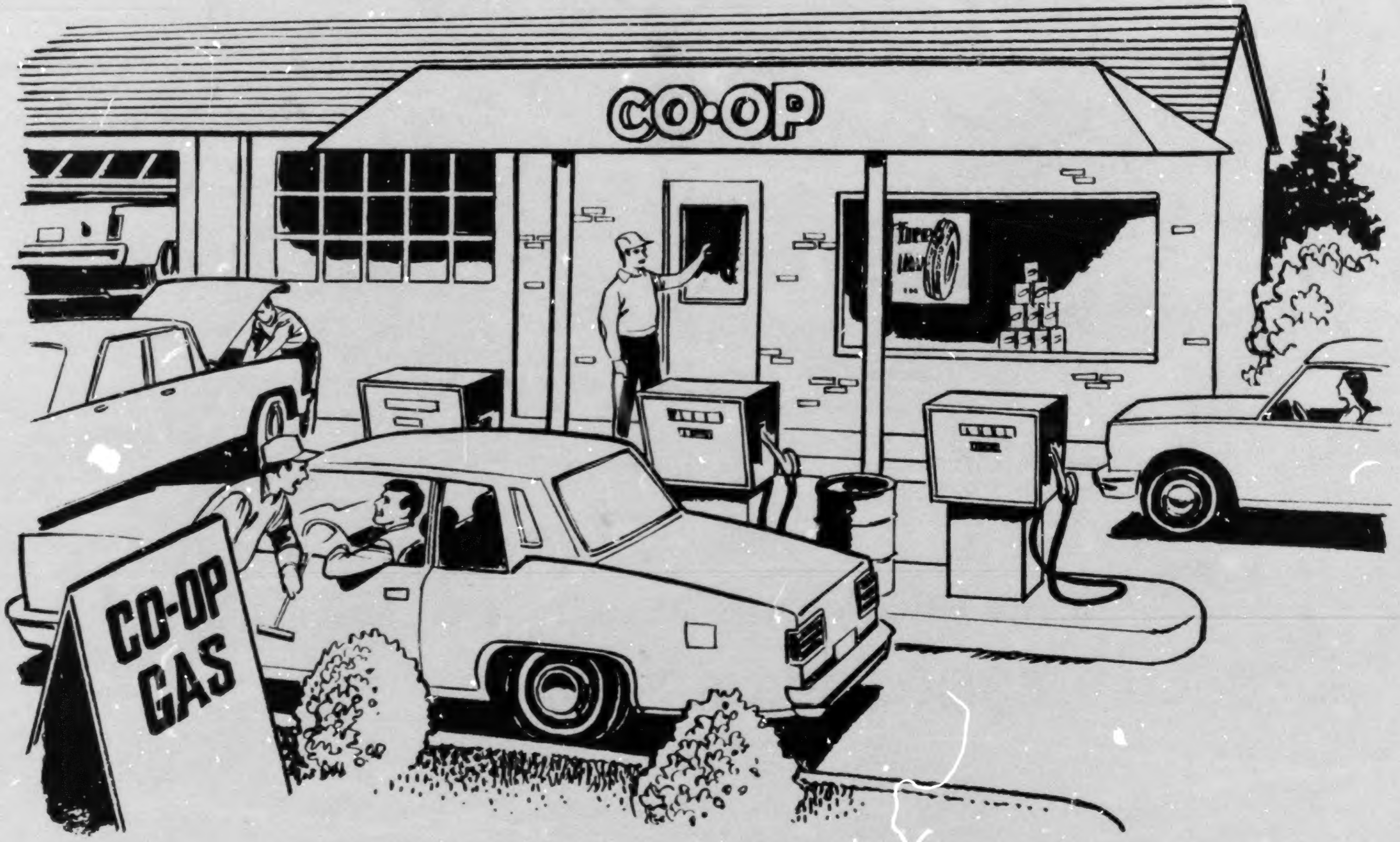

CO·OP INFORMATION
YOUR CO·OP
CO·OP
CO·OP
YOUR CO·OP
CO·OP
WHAT YOU SHOULD KNOW ABOUT A CO·OP
How to organize a CO
PROFIT SHARING
STAFFING THE CO·OP
Annual Report
CO·OP

Ag IV - V - 151

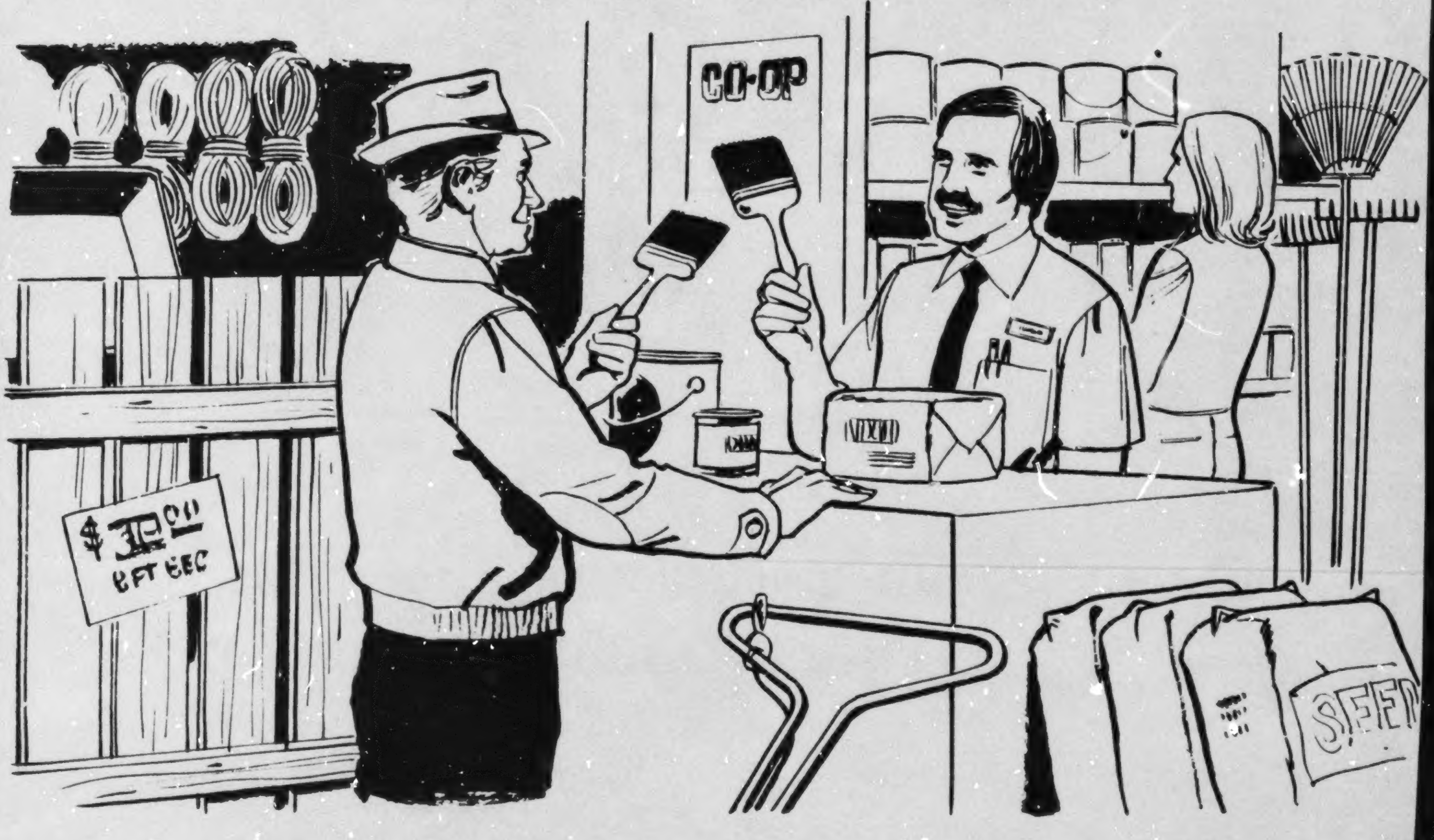
EMPLOYEE RESPONSIBILITY

. . . Fully Perform Duties

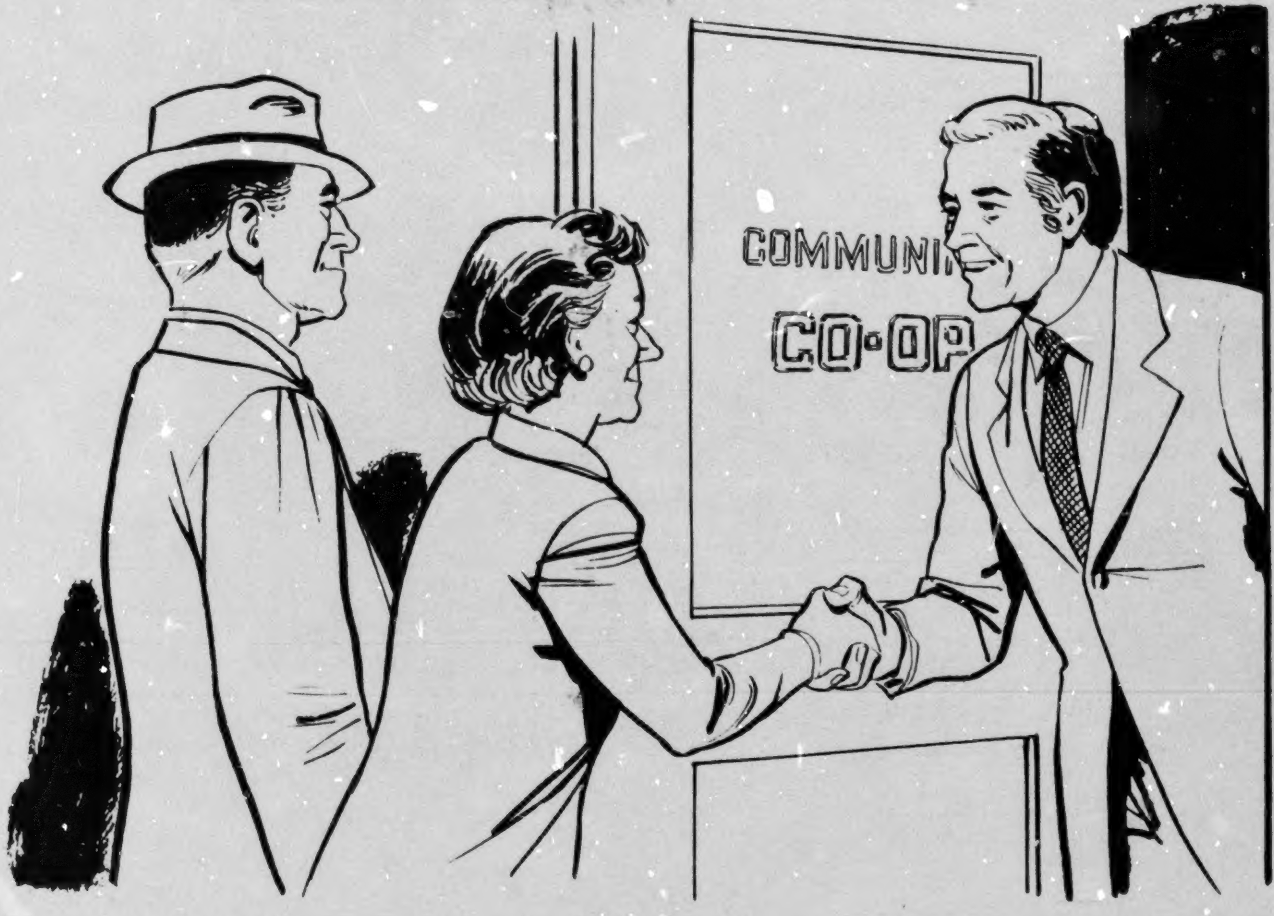
Ag IV - V - 152


CO-OP
CO-OP GAS

EMPLOYEE RESPONSIBILITY
. . . Understand Relationship to Member-Owner Patrons

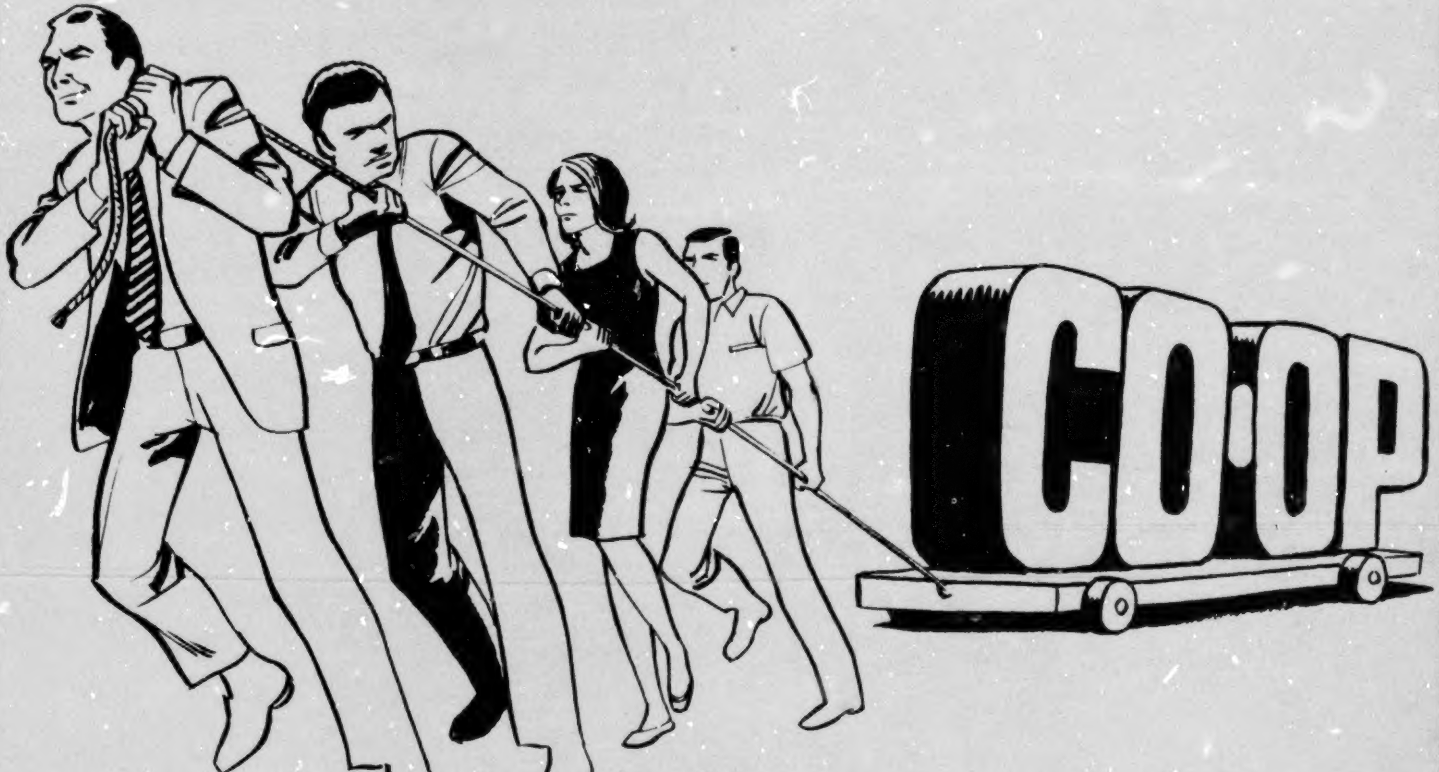

CO-OP
6FT SEC
SEE

EMPLOYEE RESPONSIBILITY
. . . Favorably Represent the Cooperative


COMMUNI
CO-OP

ECONOMIC DEMOCRACY IN ACTION

. . . Requires Everybody Working Together



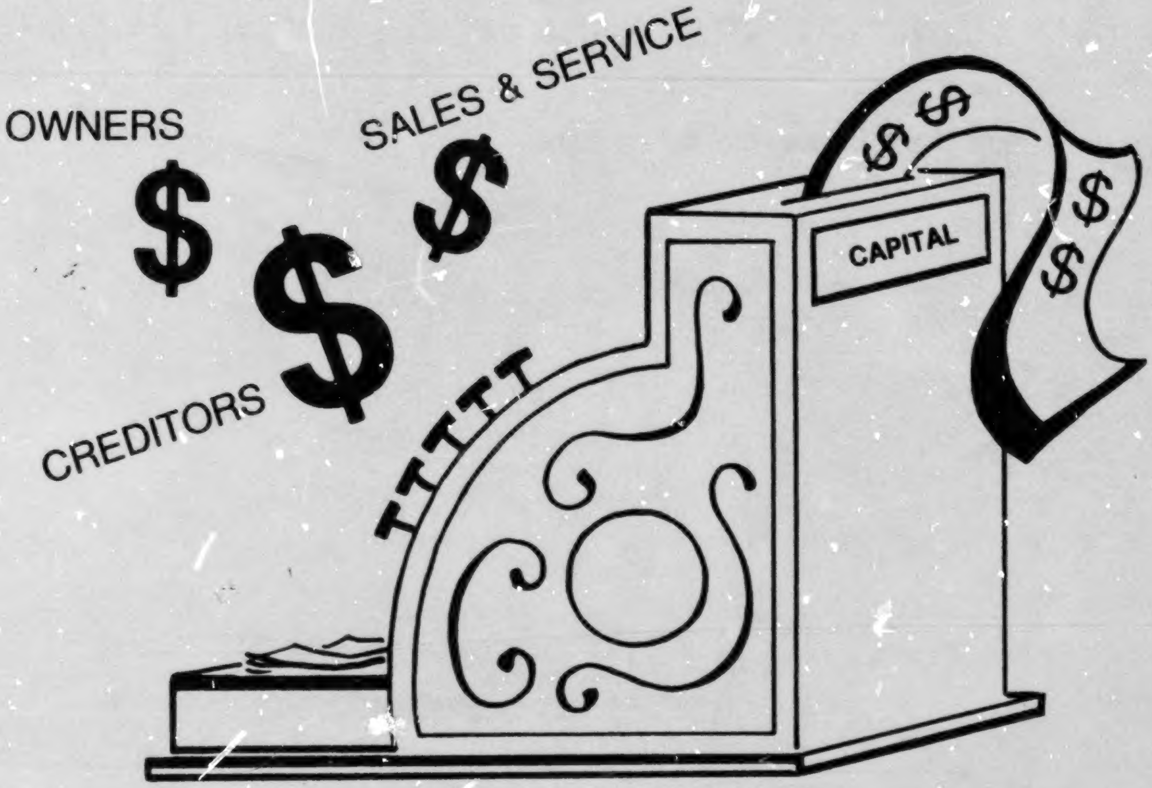
307

PRINCIPLES UNDERLYING COOPERATIVE FINANCING AND TAXATION

LESSON 4

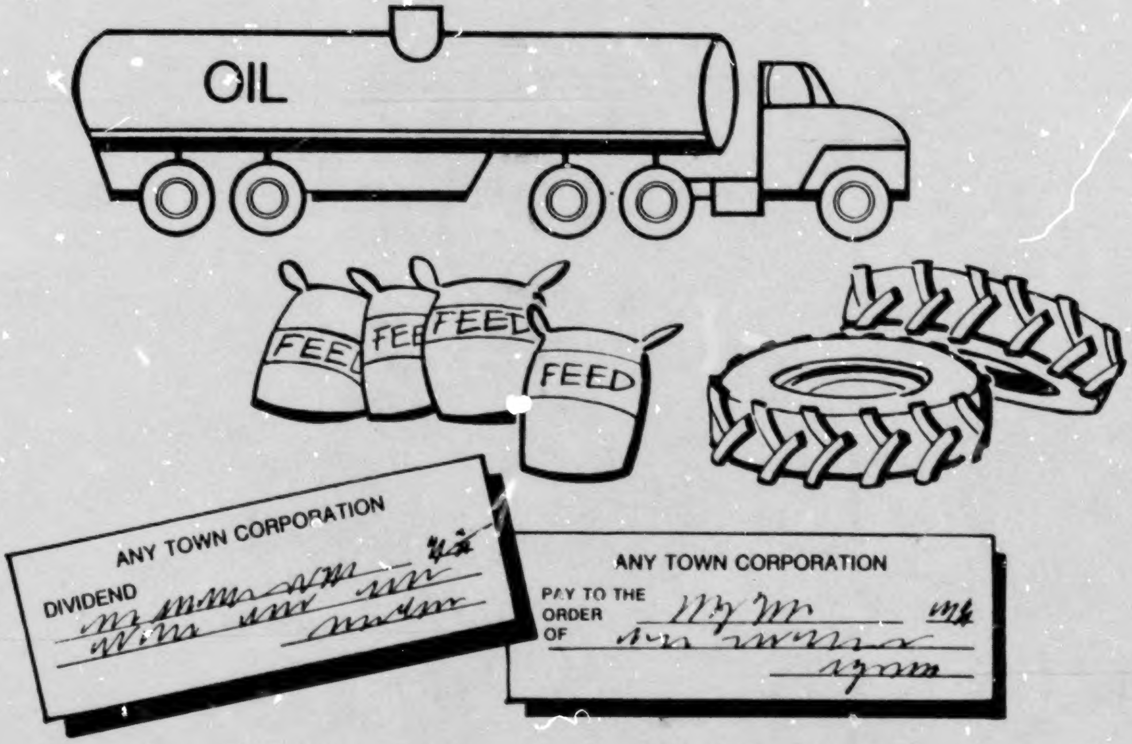
Understanding your cooperatives

STOCK
FORM 1040 IRS
PATRONAGE REFUND
PAY TO THE ORDER OF


OWNERS
SALES & SERVICE
CREDITORS
CAPITAL

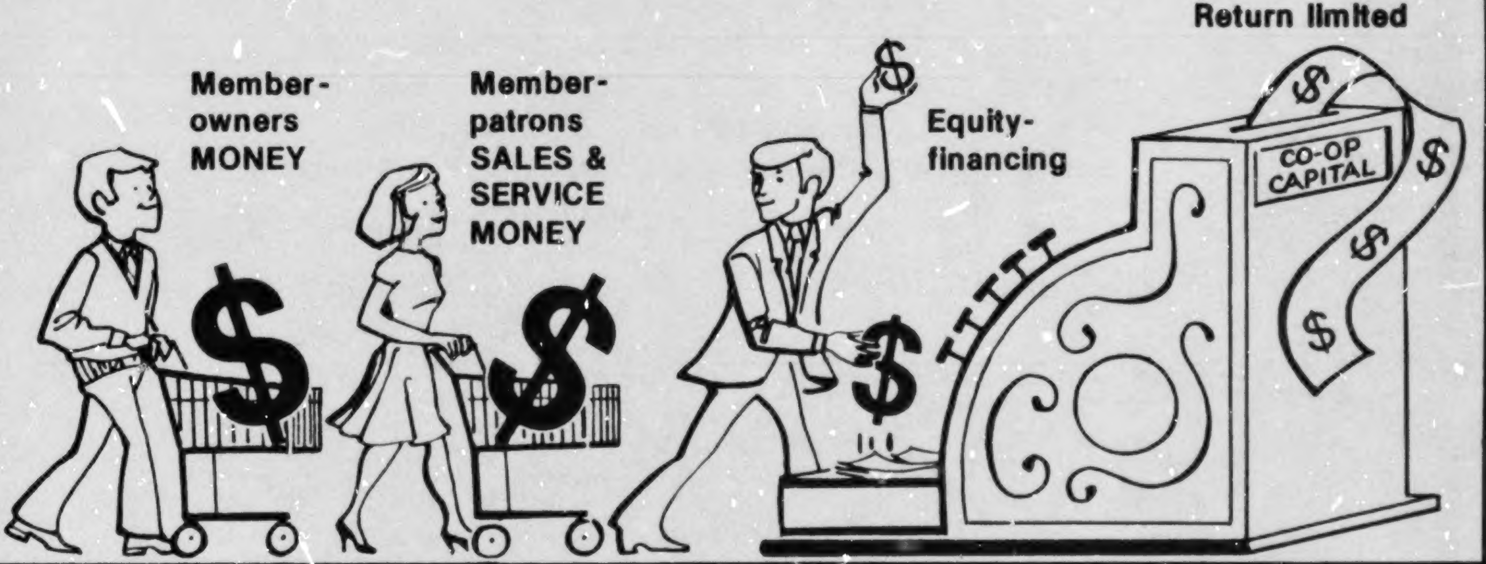
Who finances a business?

—owners as investors
—creditors as lenders
—customers as purchasers


OIL
FEED
FEED
FEED
FEED
ANY TOWN CORPORATION
DIVIDEND
ANY TOWN CORPORATION
PAY TO THE ORDER OF

How do those who finance the business benefit?

—owners get return on investment
—creditors get interest
—customers get goods and services

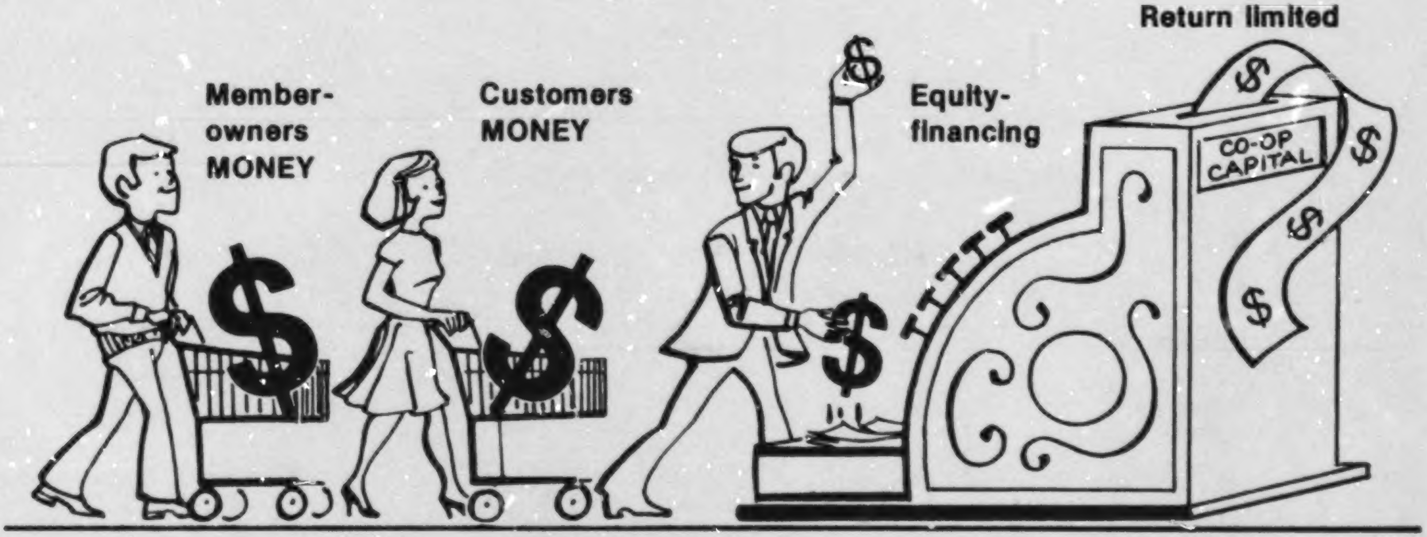

Member-owners MONEY
Member-patrons SALES & SERVICE MONEY
Equity-financing
Return limited
CO-OP CAPITAL

How does cooperative financing differ?

Purchasing and service cooperatives:

—owners and patrons are essentially the same
—equity-financing sources limited
—return on member capital is limited
—no speculative stock trading

Conclusion: Member-owners bear substantially greater burden for providing capital.


Member-owners MONEY
Customers MONEY
Equity-financing
Return limited
CO-OP CAPITAL

How does cooperative financing differ?

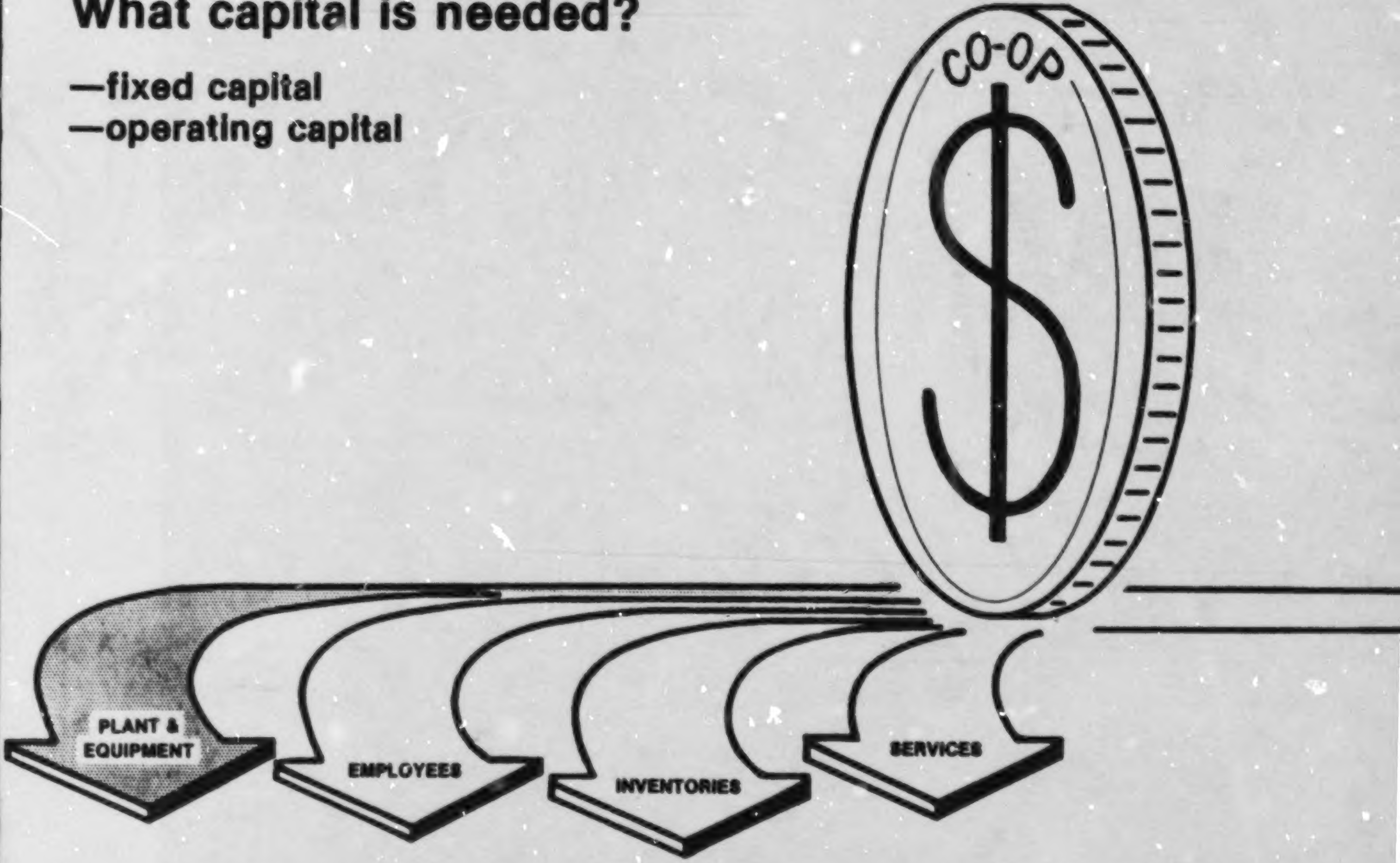
Marketing cooperative:

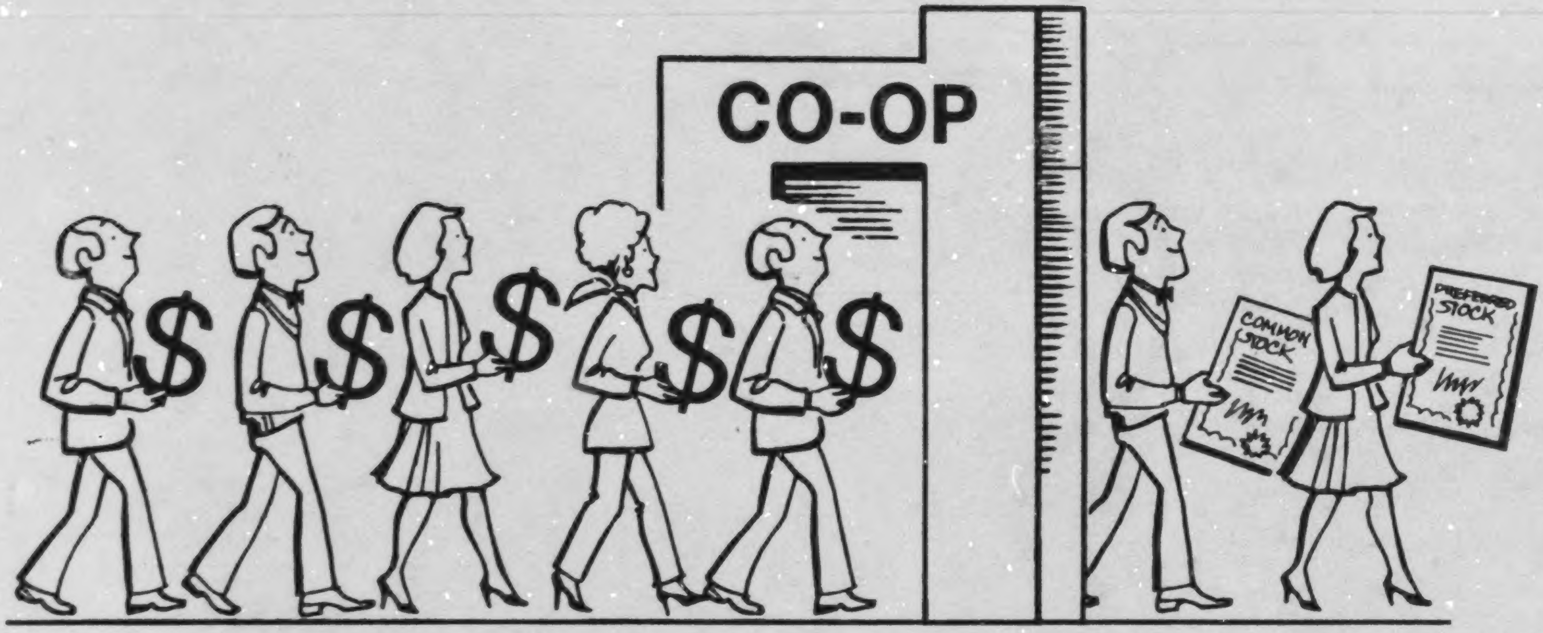
—owners and patrons are essentially the same
—equity-financing sources limited
—customers who buy farmer-members' products (indirectly, as for any business)
—return on member capital is limited
—no speculative stock trading

Conclusion: Member-owners bear substantially greater burden for providing capital.

What capital is needed?

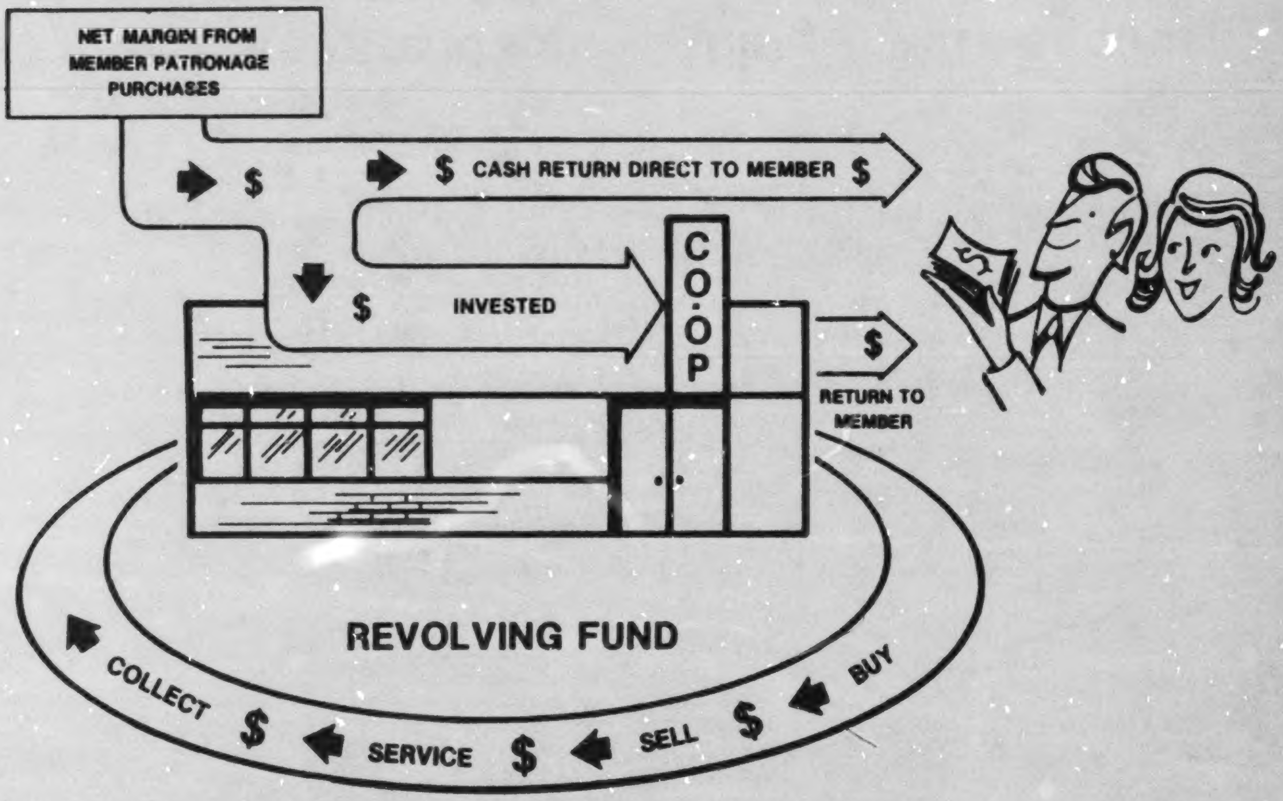
—fixed capital
—operating capital


CO-OP
$
PLANT & EQUIPMENT
EMPLOYEES
INVENTORIES
SERVICES


CO-OP
$
$
$
$
$
COMMON STOCK
PREFERRED STOCK

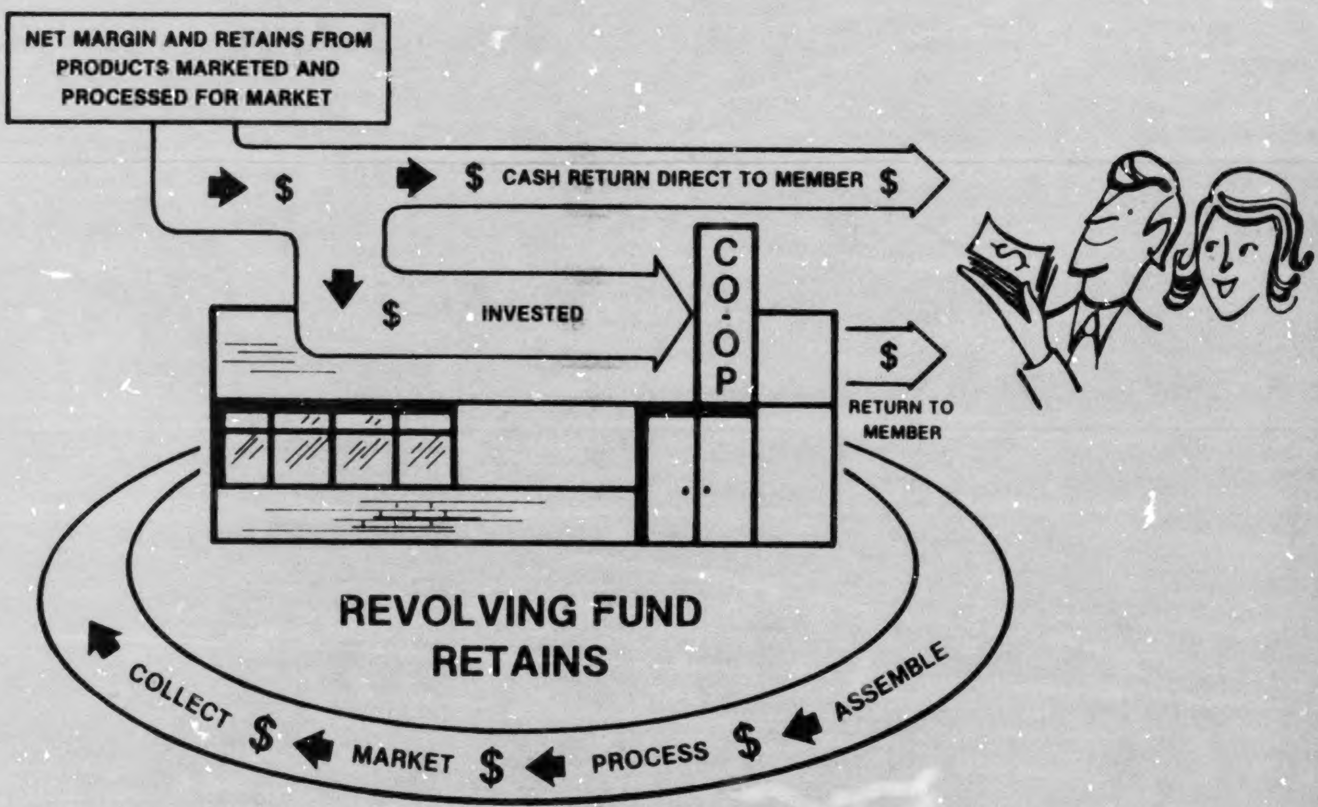
How do members provide equity capital?

—initial capital investment


NET MARGIN FROM MEMBER PATRONAGE PURCHASES
$
$ CASH RETURN DIRECT TO MEMBER $
$
INVESTED
CO-OP
$
RETURN TO MEMBER
REVOLVING FUND
COLLECT
$
SERVICE
$
SELL
$
BUY

How do members provide continuing equity capital in supply and service cooperatives?

—investment of patronage allocations

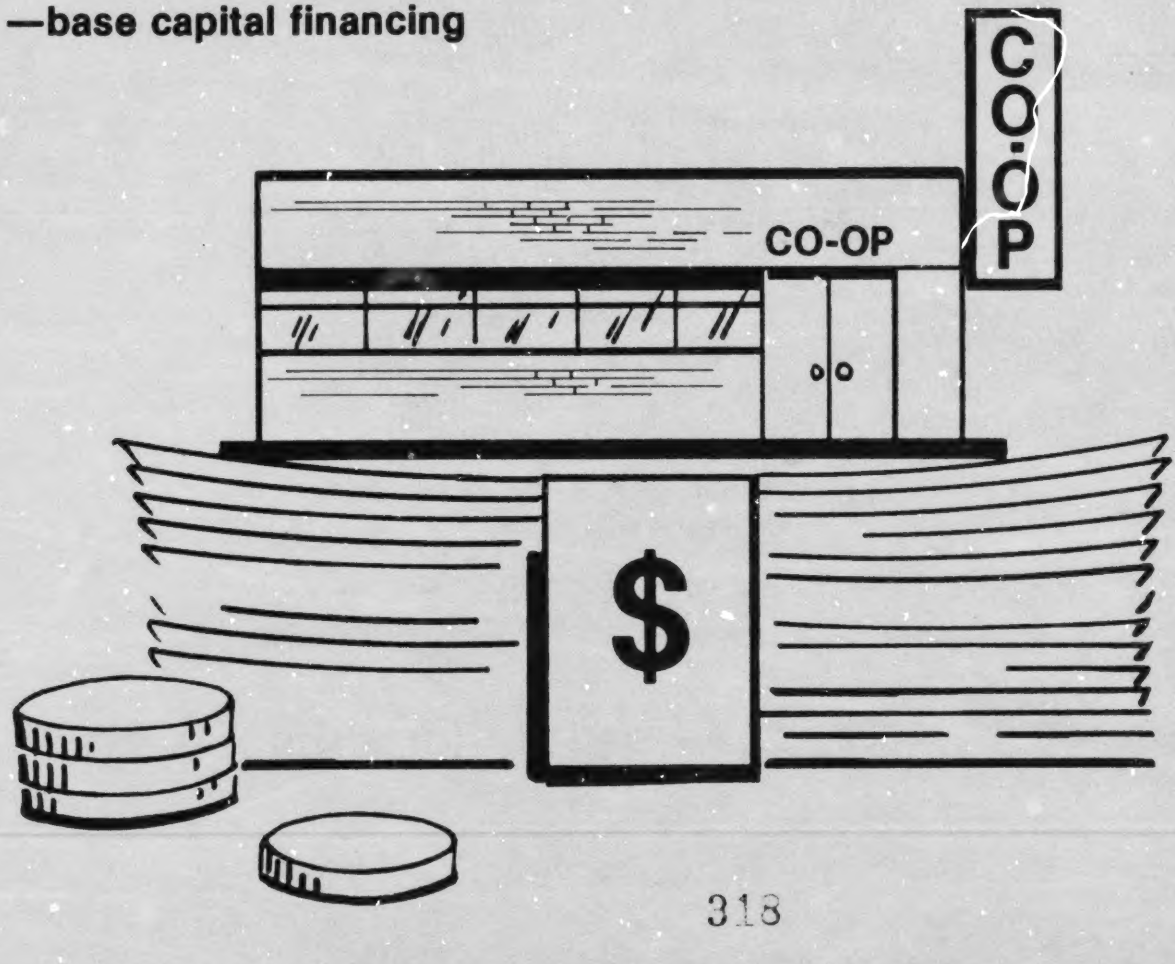

NET MARGIN AND RETAINS FROM PRODUCTS MARKETED AND PROCESSED FOR MARKET
$
$ CASH RETURN DIRECT TO MEMBER $
$
INVESTED
CO-OP
$
RETURN TO MEMBER
REVOLVING FUND RETAINS
COLLECT
$
MARKET
$
PROCESS
$
ASSEMBLE

How do members provide continuing equity capital in marketing cooperatives?

--investment of patronage allocations
--per unit retain financing

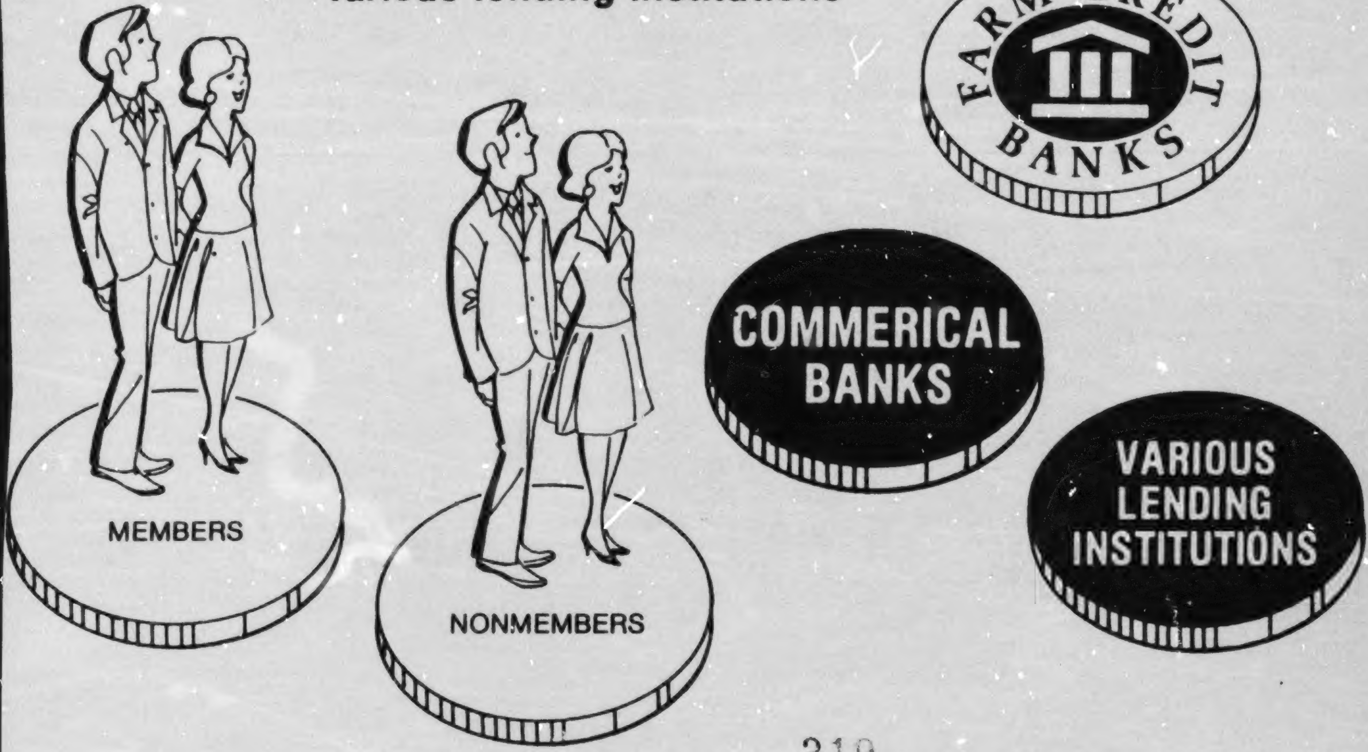
How do members provide continuing equity capital on a permanent, nonrevolving basis?

—base capital financing



Where does a cooperative get borrowed capital?

—members
—nonmembers
—Farm Credit Banks
—commercial banking system
—various lending institutions


FARM CREDIT BANKS
COMMERICAL BANKS
VARIOUS LENDING INSTITUTIONS
MEMBERS
NONMEMBERS

What are some special sources of borrowed capital?

—Rural Electrification Administration
—Rural Utilities Cooperative Finance Corporation
—Rural Telephone Bank

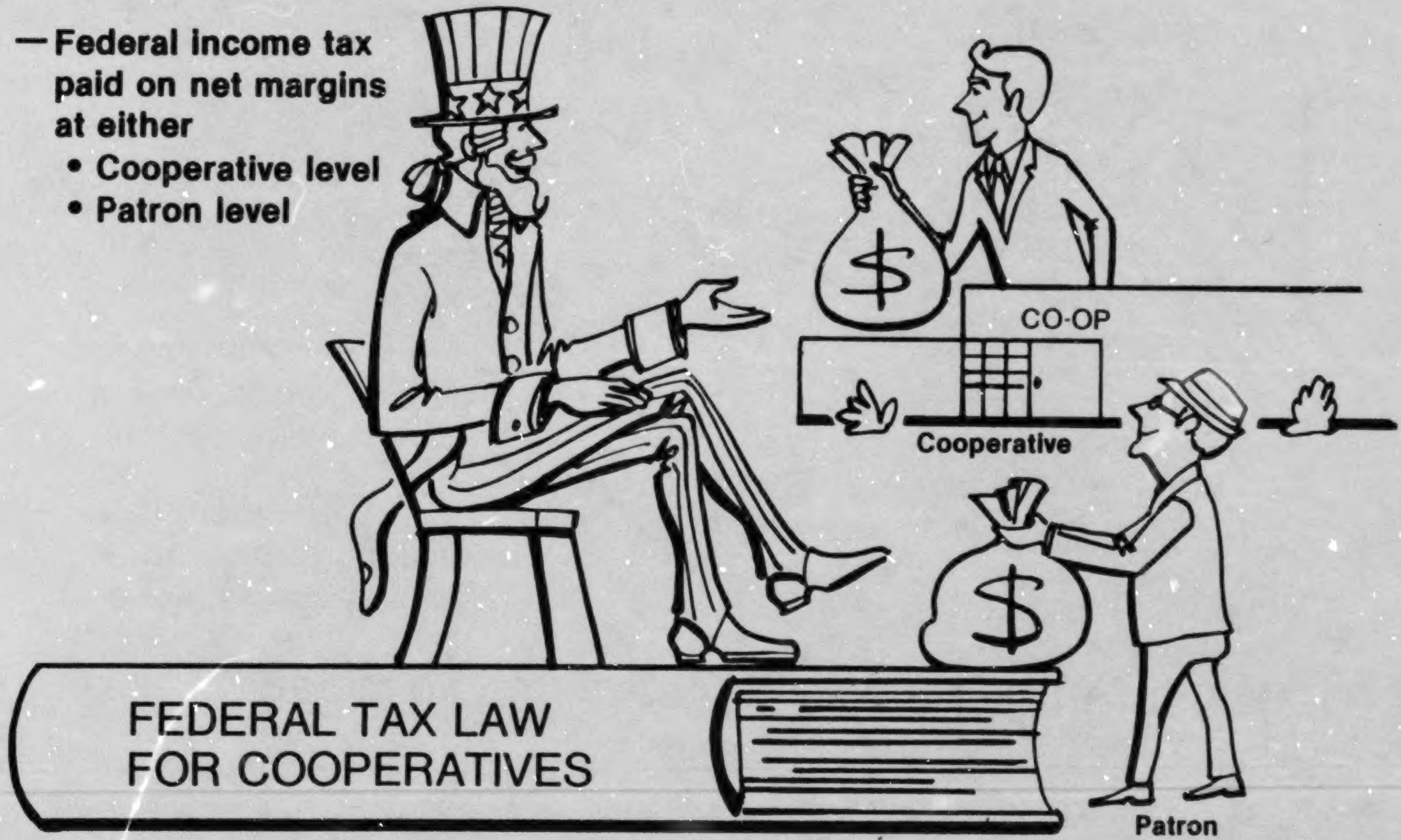
How do tax regulations apply to cooperatives?

—subject to most taxes on the same basis as other business enterprises:

- Sales
- Payroll
- Franchise and license
- Gasoline
- Real estate
- Personal property
- Excise
- State and federal income

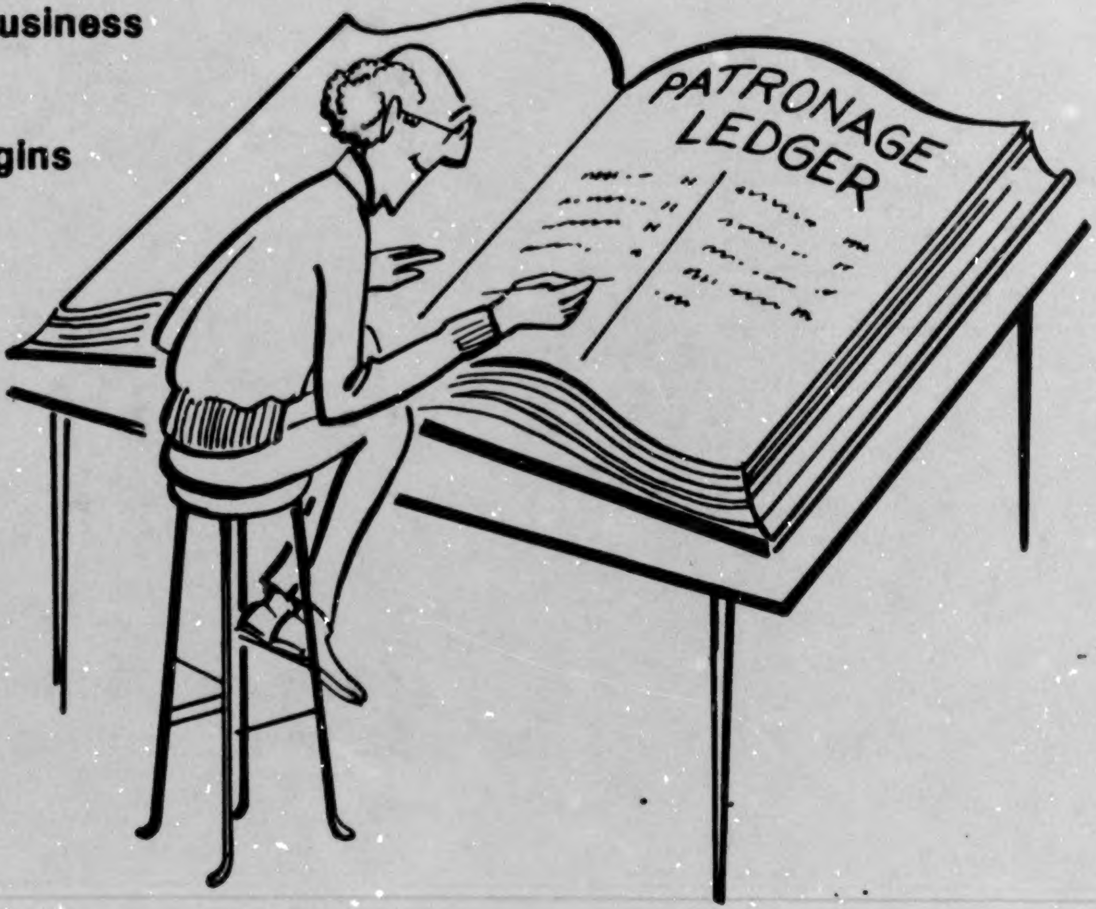
What is the principle of Federal tax law for any firm operating on a cooperative basis?

— Federal income tax paid on net margins at either
  - Cooperative level
  - Patron level


CO-OP
Cooperative
Patron
FEDERAL TAX LAW
FOR COOPERATIVES

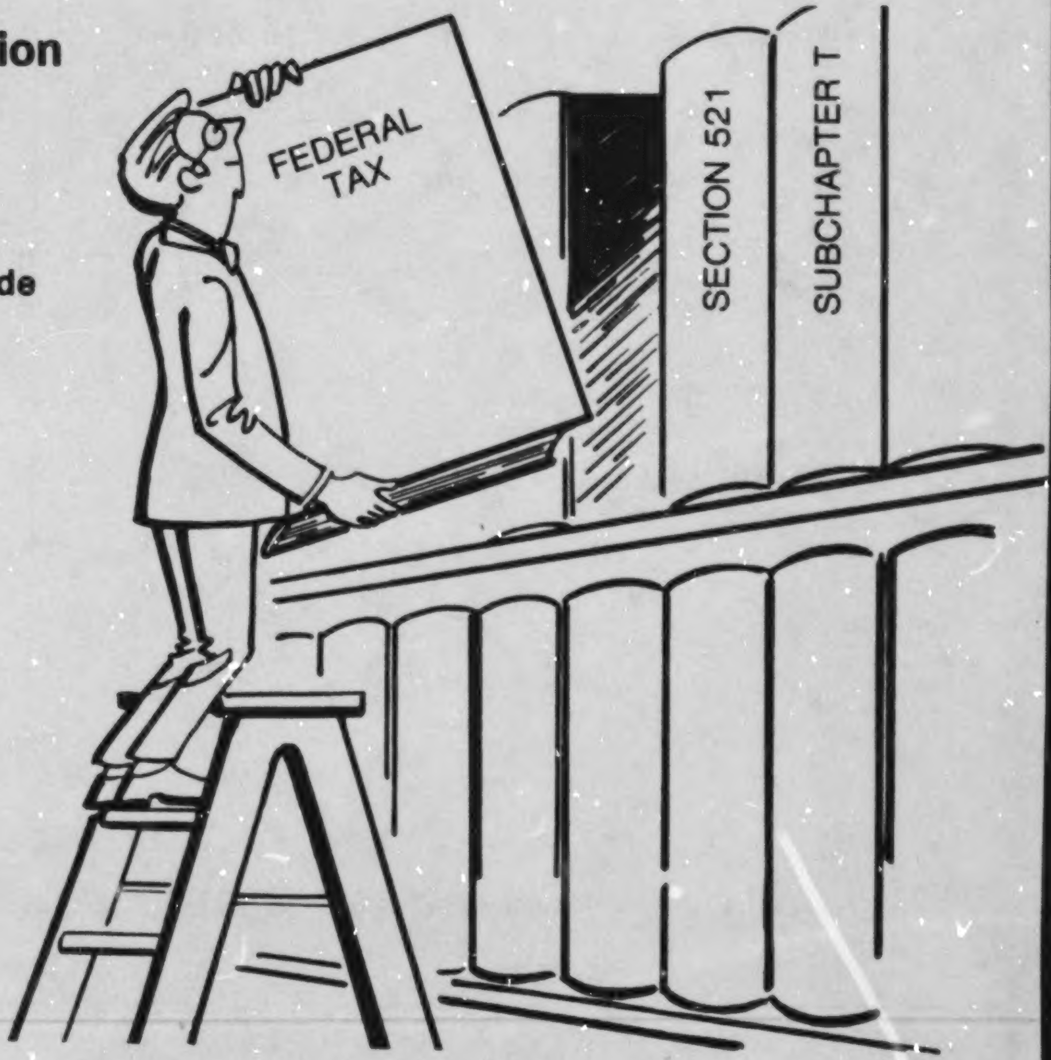
What is meant by "operating on a cooperative basis?"

- —conduct more than 50 percent of business with members
- —refund net margins in proportion to patronage

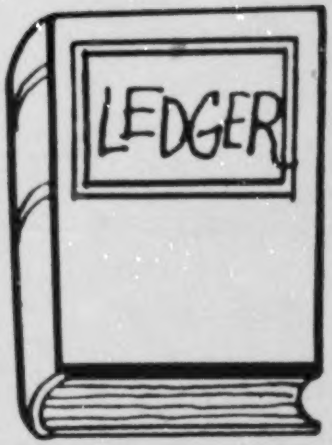


Where is information describing cooperative tax treatment?

—subchapter T, IRS Code
  —alternatives:
    nonexempt
    and
    exempt

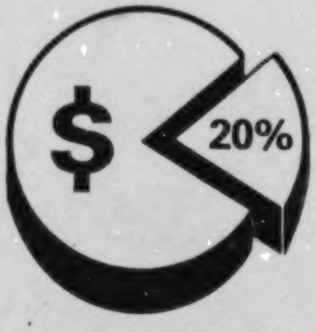

FEDERAL TAX
SECTION 521
SUBCHAPTER T

What requirements must businesses fulfill to have "cooperative" tax status?

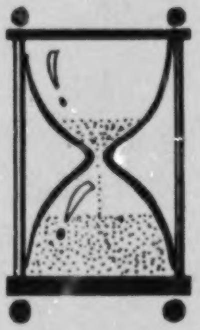


—maintain permanent:
  - —patronage records
  - —equity interest records of members

—allocate net margin on patronage basis

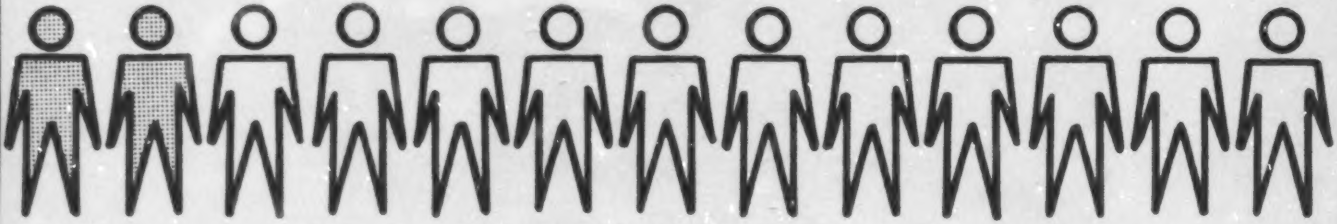


—pay at least 20 percent cash



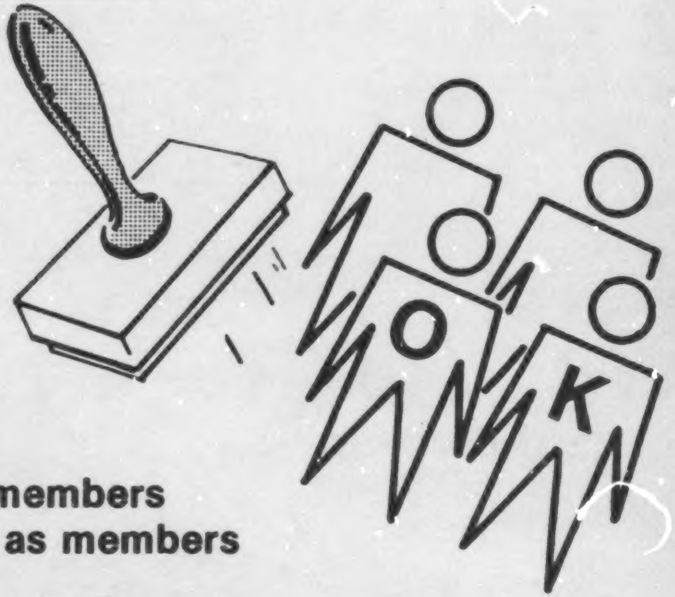
—pay within 8½ months of fiscal year closing

What requirements can a farmer cooperative fulfill to gain "limited" tax exemptions?



15%

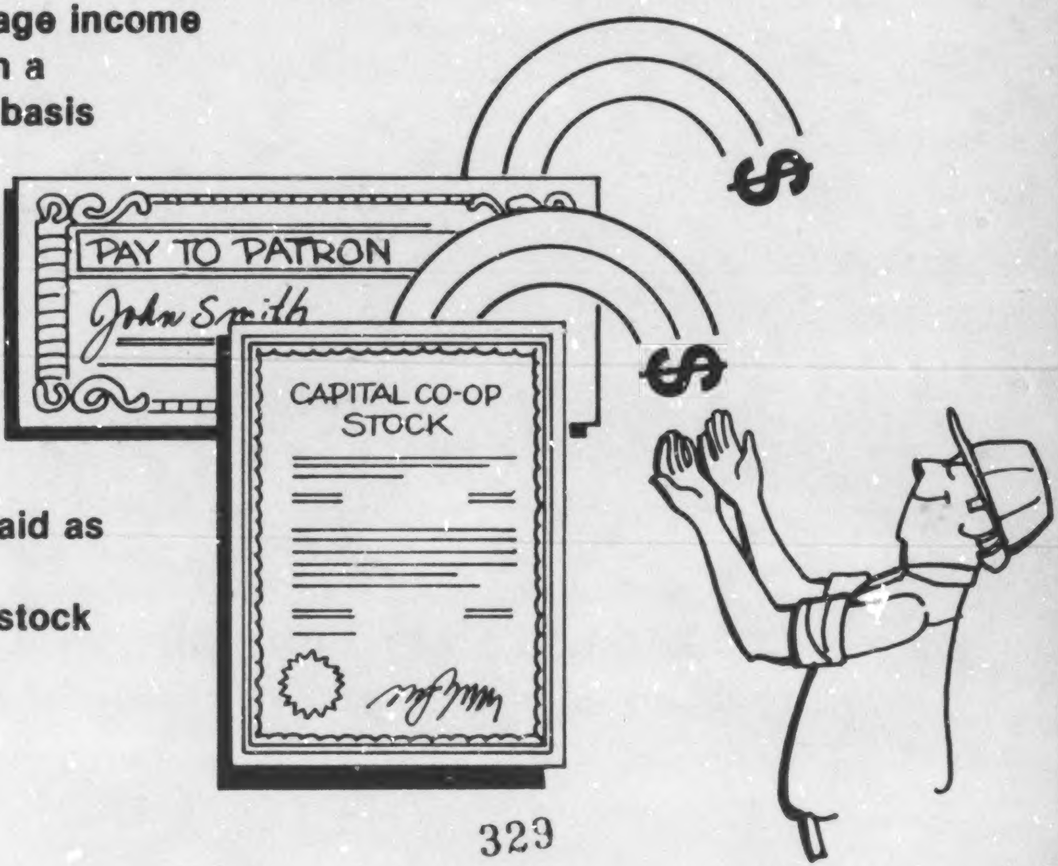
—not exceed 15 percent of business with persons who are neither members nor producers



—treat nonmembers the same as members

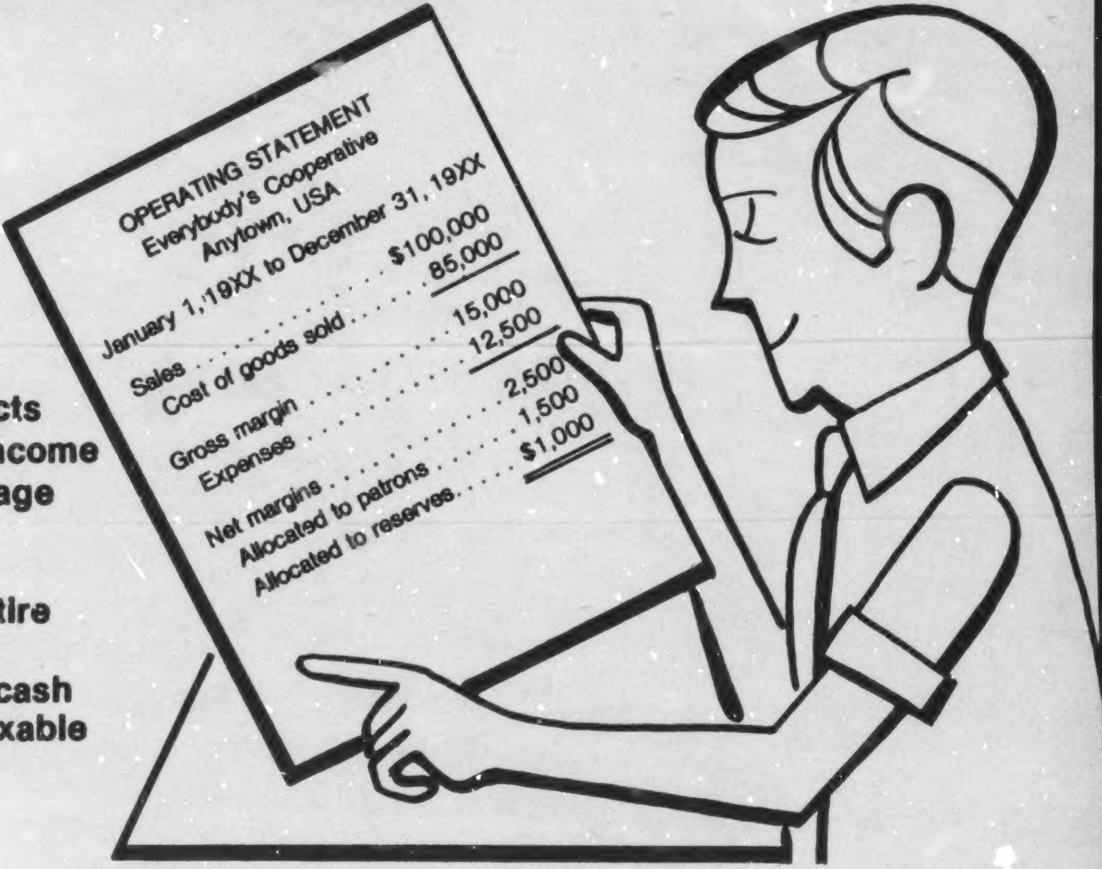
When a farmer cooperative qualifies for exemption what other tax deductions are permitted?

—amounts of nonpatronage income paid out on a patronage basis


PAY TO PATRON
John Smith
CAPITAL CO-OP STOCK
$
$

—amounts paid as dividends on capital stock

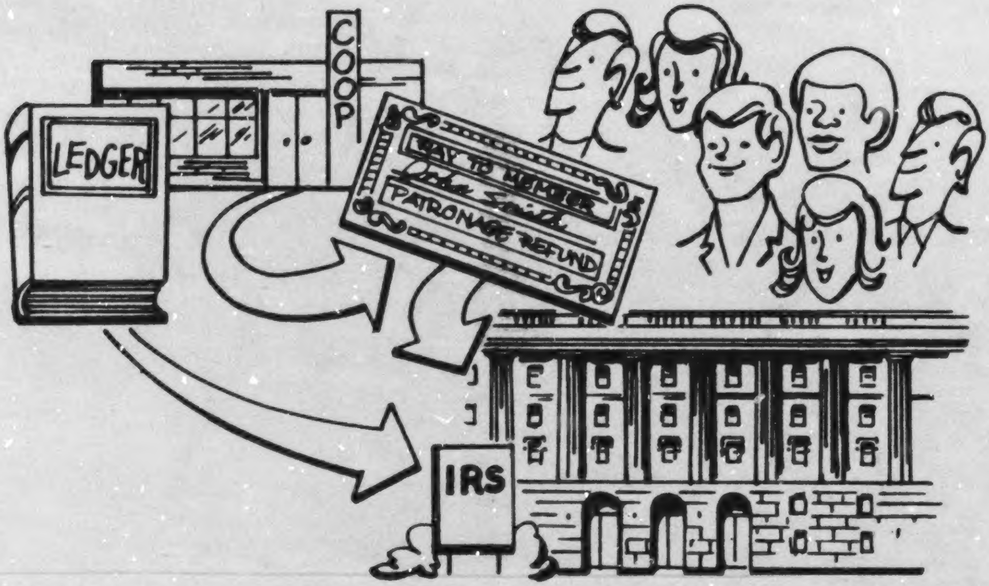
What reporting procedures must a cooperative and its member-patrons follow concerning the tax treatment of patronage refunds?



OPERATING STATEMENT
Everybody's Cooperative
Anytown, USA
January 1, 19XX to December 31, 19XX

Sales	$100,000
Cost of goods sold	85,000
Gross margin	15,000
Expenses	12,500
Net margins	2,500
Allocated to patrons	1,500
Allocated to reserves	$1,000

- —cooperative deducts from its taxable income amount of patronage refund.
- —patron reports entire refund
  - —cash and noncash as ordinary taxable income


LEDGER
COOP
PAY TO MEMBER
John Smith
PATRONAGE REFUND
$
IRS

Summary

- —member-owners bear greater burden for financing cooperative than do owners of other corporate business
- —cooperatives must meet IRS requirements
- —IRS code provides farmer cooperatives alternate methods of handling net margins
- —either cooperative or member-patron assumes income tax liability
- —cooperatives pay other taxes on the same basis as other businesses

* U. S. GOVERNMENT PRINTING OFFICE : 1979 628-471/3126

Small Gasoline Engines

Instructor's Guide:

1. This unit is provided as an option unit to an Agricultural Projects unit.
2. The objectives are given for each separate instructional area to facilitate instructor inclusion or deletion of units appropriate to the local program.
3. Build models of 2 & 4 - stroke cycle engines to help teach appropriate sections.
4. This unit includes more information than what would be used during the average time frame for small gas engines. The comprehensiveness of this unit allows you, as instructors, to utilize whatever areas of the unit you might need.

References:

1. Small Gasoline Engines, Operation and Maintenance, Hobar Publications.
2. Repair Instructions IV, Briggs and Stratton.
3. AAVIM Manuals I & II, Small Gasoline Engines.

Topic 1: Introduction

Objectives

Upon completion of this unit, students will be able to:

1. Explain course organization.
2. Explain general course goals.
3. Explain grading system.
4. Explain safety rules which will be in effect during the course.
5. Buy appropriate materials for the course.
6. Explain the importance of small gasoline engines in this society's way of life.
7. Write advantages and disadvantages of small gasoline engines.
8. Describe operating conditions of small gasoline engines.
9. Write the energy transform action sequence.

I. Safety In The Shop

  A. Industrial eye protection is required for the laboratory activities. The difference between street glasses and industrial quality eye protection is as follows:

    1. Street glasses (safety)

      a. Hardened - chemical or heated
      b. Drop ball test - 5/8" diameter 1.67 oz. 50"
      c. Thickness - 1.75 - 2.2 mm
      d. Must show maltese cross
      e. Lens is put in from back
      f. Does not meet industrial protection standards

    2. Industrial quality eye protection

      a. Hardened - heat treat only
      b. Drop ball test - 1" steel ball 4 oz. 50"
      c. Thickness - 3.0 - 3.8 mm
      d. Must show maltese cross
      e. Lens put in from front with major ridge in back
      f. Lens must bear manufacturer's mark
      g. Frame must bear manufacturer's mark
      h. Frame must meet industrial quality specifications
      i. Lens must meet industrial quality specifications

II. Small Gasoline Engine Applications

  A. How many small gas engines on your home farm, nursery and golf course?

  B. There are 70,000,000 small gasoline engines in U.S.

  C. 6,000,000 purchased each year.

  D. Classes of use for small gasoline engines include:

    1. Cultivators
    2. Concrete mixers
    3. Mowers

    4. Tractors
    5. Dusters
    6. Spreaders
    7. Elevators
    8. Generators
    9. Pumps
    10. Edgers
    11. Hoists
    12. Rollers
    13. Blowers
    14. Refrigerator units
    15. Scooters
    16. Sod cutters
    17. Green mowers
    18. Any others?
    19.
    20.

E. Small gasoline engine sizes range from 1/2 - 15 horsepower

F. Major manufacturers include:

    1. Briggs and Stratton
    2. Tecumseh - Lawson
    3. Clinton
    4. Kohler
    5. Lawn Boy

III. Advantages of Small Gasoline Engines include the following:

A. Inexpensive to purchase
B. Inexpesive to operate
C. Portable
D. Compact
E. Light in weight
F. Air cooled
G. Self-contained
H. Easy to service and repair

IV. Disadvantages of Small Gas Engines include:

A. Hard to start
B. Wear out fast
C. Not a very sophisticated engine (low efficiency)

V. Operating Conditions for small gasoline engines generally include:

A. High speed - (Run wide open most of the time).
    1. Car - 82 mph = 3600 RPM
    2. Chainsaw = 6000 - 8000 RPM
    3. Small 4-stroke cycle - 3000 - 4000 RPM continuous operation

VI. What does an engine do?

A. Convert fossil fuel energy into mechanical energy.

    1. How does an engine do this?

        a. Fossil fuel (chemical energy) - mix gas and air (a process called atomization).

b. Burn gas (heat energy released) expansion pressure from burning causes pressure in combustion chamber.
c. Piston is forced down (mechanical energy - reciprocating action).
d. Crankshaft transfers reciprocating action to rotating action in which form it can be used. Chemical energy - heat energy - mechanical energy

Topic 2: 2 & 4-Stroke Cycle Engines

Objectives

Upon completion of this unit, the student will be able to:

1. Describe the sequence of events for 2 & 4-stroke cycle engines
2. Describe relative advantages and disadvantages of 2-stroke compared to 4-stroke cycle engines
3. Explain basic design types for 2 & 4-stroke cycle engines
    a. Heads
    b. Blocks
4. Classify parts of small gasoline engines
5. Identify part function, forces acting on parts and materials that the parts are constructed from

Materials

1. Models - 2 & 4-stroke cycle

Introduction

1. What is the difference between 2 & 4-stroke cycle engines?
2. How is the energy transformed - actions handled - what parts are necessary?
3. Use models

I. Events necessary in an internal combustion engine*

A. Intake - air and fuel
B. Compression
C. Ignition - Combustion
D. Power stroke
E. Exhaust

*Use models to show sequence.

II. When these six events take place in 4 strokes, it is a 4-stroke cycle engine.

*Illustrate using model.

III. These six events can be done in 2 strokes, 2-stroke cycle engine

*Illustrate using model.

IV. Comparison of 2 & 4-stroke cycle engines

4-stroke cycle engines	2-stroke cycle engines
more fuel efficient	higher RPM operation
oil in sump (one position operation)	light weight
torque over a wider RPM range	oil mixed in fuel (use any position)
higher volumetric efficiency	more horsepower per cubic inch

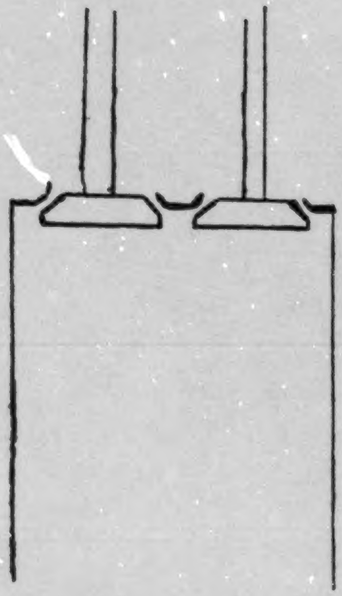
V. Engine Design

A. Single cylinder

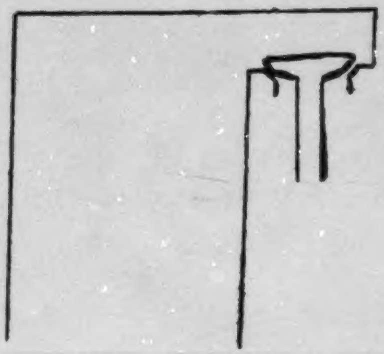
1. Horizontal } Refers to positions of crankshaft
2. Vertical }

VI. Head design

A. I - Head - both valves in head. Most efficient valve design for intake and exhaust gas movement.



B. L - Head - valves in block. An inexpensive design because of camshaft, tappet and valve location, not as efficient in intake and exhaust gas movement as an I - Head design.



VII. Classification of parts

A. Stationary parts - parts which do not move.

1. Block
2. Head

B. Reciprocating - parts which move up and down.

1. Piston assembly - rings, wrist pins and connecting rods

  2. Valves - tappets, lifters, cam followers, keepers, springs, push rods and rocker arms

C. Rotating - parts which move in a circular motion.

  1. Crankshaft
  2. Flywheel
  3. Camshaft

D. Accessories - parts needed for consistant engine operation.

  1. Carburetor (air fuel mixture)
  2. Ignition system (spark plug & flywheel magneto)
  3. Cooling system (fins, flywheel, and shroding)
  4. Charging system (if present - starter/generator)
  5. Starting system (if present - starter/generator)

VIII. Parts, functions, forces and materials

Part		Function	Force	Material
A.	Block	Hold parts, bearings, oil supply, contain pressure (cylinder) and transmit heat	Shock, friction, heat and pressure	Cast: aluminum alloy or iron
B.	Head	Provide containment of pressure, may contain valves. and ports and transmit heat	Shock, friction heat and pressure	Cast: aluminum alloy or iron
C.	Piston	Movable part, cylinder-compression, hold rings and transmit heat	Shock, friction, heat and pressure	Cast: aluminum alloy or iron
D.	Connecting rod	Transmit power from piston to crankshaft	Shock, pressure or compression and friction	Cast or forged: aluminum or steel alloy
E.	Piston pin	Connect piston and connecting rod	Shock, bending and friction	Cold rolled tempered steel
F.	Valves	Control action of combustion chamber (let gas-air in and exhaust out) and transmit heat	Heat, shock, friction corrosion and pressure	Steel: tungsten or stellite alloying
G.	Tappets, lifters and cam follower (push rod and rocker arm)	Actuate valves and follow cam	Shock, pressure and friction	Machined or stamped steel alloys
H.	Crankshaft	Transforms reciprocating force to rotating force, transfers forces to outside of engine, turns flywheel, turns cam and may open points	Shock, twist and friction	Cast or forged: steel alloys
I.	Camshaft	Operates valves, operates distributor, operates governor, operates oil splash and turns 1/2 as fast as crankshaft	Twist, friction and shock	Cast or forged: steel alloy
J.	Flywheel	Provides rotating action outside, balances and may hold magnets for ignition system	Centrifugal	Cast: Aluminum alloy and/or iron
K.	Bearings	Provide close tolerances for smooth rotating action	Friction, shock and pressure	Aluminum alloys of lead, tin, copper, silver and cadium
L.	Rings	Seal compression, control oil, reduce friction and transmit heat	Shock, friction and pressure	Cast iron for compression rings, oil rings may be cast iron or steel with moly or chromium face

Topic 3: Valves

Objectives

Upon completion of this unit, the students will be able to:

1. Identify the parts of a valve system
2. Explain operation and function of valve systems
3. Identify common failures and reasons for failures

Materials

1. Transparencies
2. Models
3. Bad valves

Introduction

1. Valves operate under severe conditions; look what might happen to them. (bad valves to show to the class)
2. What causes this?

I. Valve system

   A. Valves operate under severe conditions

      1. Time of operation 1/50 - 1/75 of a second open to close.
      2. Heat - exhaust valve operates at 1200 - 1300° F. in an area heated as high as 2500 - 2700° F.
      3. Pressure - 500 psi + on ignition in combustion chamber.

   B. Effect of air-fuel ratio on heat in combustion chamber

      1. Lean mixture causes the engine to run hot, thus valves burn more readily.
      2. Rich mixture causes carbon deposits which may hold valves open.

   C. Valve parts

      1. L - head assembly

   D. Interference angle -

      1. Face to seat difference in angle which is ground to provide rapid seating of valves
      2. 1 to 1 1/2° difference (i.e. valve ground at 45° seat ground at 40°)
      3. Must seat at top to prevent carbon deposits from holding the valve open.

   E. Valve failures

      1. Wrapped
      2. Burned
      3. Dished
      4. Necked
      5. Thin margin

   F. Oil consumption by guides

1. After a valve job oil may be consumed by the intake valve guide unless the valve stem and guide are properly fit (i.e. in guides and valves or knurling of guides).

II. Camshaft lobe design (see diagram)

A. Start TDC intake stroke (both open)
B. Intake close 30° past BDC
C. Ignition 20° before TDC (compression stroke)
D. Exhaust open 35° before BDC (compression stroke)
E. Intake open 10° before TDC (exhaust stroke)
F. Exhaust close 10° past TDC (intake stroke)
G. Duration range - length of time a valve is open

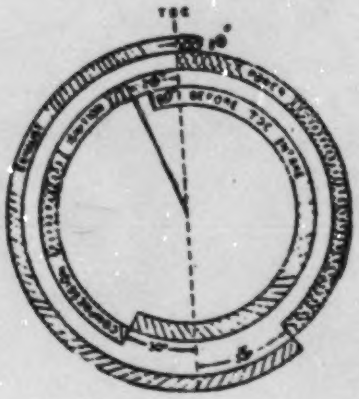
   1. Intake 220° (out of 720°) $10^\circ + 180^\circ + 30 = 220^\circ$ of duration
   2. Exhaust 225° (out of 720°) $35^\circ + 180^\circ + 10^\circ = 225^\circ$ of duration

H. Overlap - length of time valves are both open

   1. Intake stroke $20^\circ - 10^\circ + 10^\circ = 20^\circ$ around TDC before intake

I. Lift

   1. Cam lift - height of lift or amount of lift.
   2. Valve lift - height valve is lifted from seat. (Rocker arms on I-Head engines are usually made at either a 1.2 or 1.5 to 1 ratio; therefore, the valve lift is more than the cam lift.)



Intake opening - 10° before TDC
Intake closing - 30° past BDC
Ignition - 20° before TDC
Exhaust opening - 35° before BDC
Exhaust closing - 10° past TDC

Topic 4: Pistons

Objectives

Upon completion of this unit, the students will be able to:

1. Describe conditions of piston functions
2. Identify piston structural parts
3. Describe how pistons are built for expansion
4. Describe how the piston operates, thrust forces and wear patterns

Materials

1. Transparencies
2. Pistons

Introduction

1. We discussed valves last time; the pistons operate under the same conditions.
2. How can we help aluminum withstand the heat pressure and expansion problems encountered in operating under these conditions?

I. Piston Assembly

- A. Piston
  - 1. Operating conditions
    - a. Strong enough to withstand tremendous heat and pressure.
    - b. Yet light to avoid excessive inertia forces when changing direction of travel twice/revolution.
    - c. Must withstand heat from burning gas.
    - d. Must slide freely within the cylinder; cannot be fitted too tightly.
    - e. If fitted loosely, they will knock and rattle.
  - 2. Advantages of aluminum over cast iron or steel
    - a. Lighter weight means less inertia forces for reciprocating parts -- allowing higher speed operation.
    - b. Lowered inertia forces also allow decreased bearing loads.
    - c. Lighter weight also means less side thrust on cylinder thus reducing wear.
    - d. Greater heat conductivity allows cooler running and higher compression ratios.
  - 3. Disadvantages of aluminum pistons
    - a. Expand more than cast iron; therefore, they must be fitted somewhat looser (piston design and alloying have overcome this problem to a great extent).
    - b. Aluminum strength is reduced when heated causing broken or deformed lands; engine normal operating range is ok but overheating an engine can be serious.

4. Alloying materials for aluminum piston include: copper, magnesium, nickel, and silicon
5. Piston construction
    - a. Crown - flat, concave or convex to promote turbulence or help control combustion.
    - b. Heat dam - narrow groove above top ring to reduce the amount of heat getting to the top ring.
    - c. Piston ring grooves - carry rings and separated by lands.
    - d. Skirt, under part of piston, provides the bearing area in contact with cylinder; it takes the thrust forces caused by crank pin location.
        1. Major thrust side, side opposite crank throw on power stroke.
        2. Minor thrust side, side opposite crank throw on compression.
    - e. Piston bracing -
        1. Ribs - cast into the inside of piston to strengthen area between crown and boss.
        2. Steel inserts - control expansion and add strength.
    - f. Piston design - allows close fit of aluminum piston in cast iron blocks
        1. Strut - use steel insert (skeleton-like and aluminum cast around it)
        2. Steel belt - steel ring cast into piston
        3. Aluminum pistons are cam ground
            - (a) Close fit on thrust surfaces, perpendicular to pin bosses and boss area fits loose when cold. As heat increases, piston expands and more thrust surface is available for use.
            - (b) Pin boss area doesn't change position appreciably.
            - (c) Pistons tapered narrower at top than bottom especially above top ring. (Reason: top runs hotter than bottom and expands more).
            - (d) Piston relief - indentation in mid skirt around boss to help prevent freeze up in overheating.
    - g. Measurements important in cylinder piston area
        1. Measure taper from approximate first ring TDC to oil ring BDC. (Guide: 2 to 3 thousandths per inch of diameter is maximum allowed without reboring.)
        2. Measure piston clearance - feeler guage beside piston 1" down on thrust sides to piston skirt. (Guide: 1 to 2 thousandths per inch of diameter max.) (Fit at .001/in. diameter when new.)

Topic 5: Rods, Cranks, & Balance

Objectives

Upon completion of this lesson, the students will be able to:

1. Explain piston pin construction and function
2. Explain ring construction, location and function
3. Explain connecting rod construction and function
4. Identify bearing construction and function
5. Identify crankshaft construction and function
6. Identify sleeve construction and function
7. Explain the balance and vibration in engines
8. Identify piston speed and travel variances

Materials

1. Transparencies
2. Piston pin
3. Connecting rod
4. Rings
5. Sleeve
6. Crankshaft

Introduction

1. How does the pressure exerted on the top of the piston get to be rotary-power at the flywheel?

I. Types of Piston Pins - tight fit (press fit)
  A. Pin secured to piston (least bearing area)
  B. Pin secured to rod (bearing area in piston only)
  C. Pin full floating with lock rings or soft plugs at both ends (most bearing area and least weight; no screws or bolts to secure one part)

II. Rings (cast iron - oil control rings may be multi-sectioned steel rings).
  A. Function
    a. Seal compression
    b. Control lubrication
    c. Reduce friction
  B. Classification
    a. Compression
    b. Scrapper (functions as both compression and oil control but is primarily compression)
    c. Oil control
  C. Measurements
    a. Ring end gap (gap at end of ring when inside the cylinder).

b. Ring groove clearance (side clearance between the ring and piston land).

D. Design

1. Top ring - rectangular in cross section and bevel cut on inside upper corner (allows ring to tilt and seal) (maybe chrome or moly-coated for wear).
2. Second ring - primarily a compression ring but also works in oil control; bevel cut may be on inner or outer corner and may be tapered on inside or outside.
3. Third ring - may be multi-section, has slots for oil return through slot in piston to oil sump and may be either cast iron or hardened steel, may have a chrome or moly-plated face to reduce friction and increase life.

III. Connecting Rod - aluminum or steel (boxed or "I" beam)

A. Pin bearing - insert aluminum if the rod is steel or precision drilled hole if the rod is aluminum.
B. Spray hole - spray oil on piston bottom side for cooling.
C. Connecting rod bearing - precision aluminum insert if rod is steel and aluminum rods are precision machined to crankshaft journal size.
D. Oil splash system - dipper
E. Installation - match marks of rod and cap and make sure inserts are installed with marks in correct position (Mark before disassembly if unsure).

IV. Crankshaft and Main Bearings

A. Crankshaft design (forged steel or cast steel)

1. Parts -

   a. Magneto journal
   b. Crank pin journal
   c. PTO journal
   d. Throw
   e. Counterweights

2. Bearing - aluminum precision inserts

B. Balance of crankshaft

1. Static balance - weight equal in all directions from center when the crankshaft is at rest
2. Dynamic balance - balance while crank is turning (obtained when the centrifugal forces of rotation are equal in all directions at any point)
3. Counterweights balance the weight of the piston and rod assembly. In addition to balancing the crankshaft proper, the entire rotating assembly is balanced dynamically including:

   a. Timing gears
   b. Crankshaft
   c. Flywheel
   d. Blades on lawnmowers

4. Piston - rod assemblies are balanced one with another so that the rotating mass will have as little vibration as possible.

5. Torsional vibration - twist (torque) applied by piston on the power stroke puts that slight twist in crankshaft as the flywheel inertia forces lag behind. (Solution: weight at both ends (i.e. lighter flywheel and use lawnmower blade as part of balance assembly).

*NOTE: Don't run lawn mowers without blades.

6. Critical speeds - no matter how well balanced, an engine will have vibrations at certain speeds. Causes:
   - a. Difficulty of balancing rotating parts with reciprocating parts.
   - b. The start and stop action of piston assembly.
   - c. Acceleration and deceleration speeds (velocity of piston) different in each quarter of crankshaft revolution.

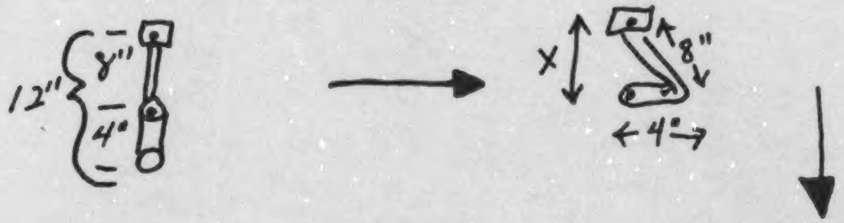
V. Sleeves - (cylinder inserts) (some aluminum blocks have steel insert sleeves for longer wear).

- A. Sleeve fitted in the block cylinder - thin, high strength sleeve
- B. No leakage problems
- C. Sleeves rattle - score and wear (steel expands at a different rate than aluminum).
- D. Sleeves add weight to the engine

VI. Piston distance travel in relation to crank position. (First quarter down and out; second quarter down and in, and last 1/8 partially none).

A. 8" Connect rod

4" Throw on crankshaft



$4^2 + x^2 = 8^2$

$16 + x^2 = 64$

$x^2 = 48$

$x = 48$

$x = 6.9282032$

or

$x = 7$

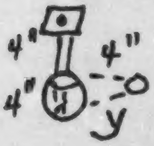
A = 12" - x

A = 12" - 7"

A = 5" of stroke in first 90° of crankshaft rotation

A = stroke in first 90° of crankshaft rotation

Therefore there are only 3" of stroke in the last 90° of crankshaft rotation



B = x - 4"

B = 7" - 4

B = 3" of stroke in the second 90° of crankshaft rotation

B = stroke in second 90° of crankshaft rotation

OR B = total stroke - A

B = 8" - %"

B = 3"

B. Travel differences

1. The travel down in the first quadrant is increased by the distance down (1/2 the stroke) and the difference out (from center to 1/2 the stroke out at 90° angle).
2. The travel in the second quadrant is reduced by the amount of gain in going off center in the first quadrant.
3. The third quadrant corresponds to quadrant two.
4. The forth quadrant corresponds to quadrant one.

Topic 6: Engine Terms

Objectives

Upon completion of this lesson, the student will be able to:

1. Define basic engine terms
2. Calculate figures described by basic engine terms (i.e. displacement, compression ratio, etc.)

Materials

1. Calculator
2. Chalkboard
3. General specifications bulletins

Introduction

1. Read items from bulletin (i.e. displacement, compression ratio, piston speed, etc.)
2. What are these and how do we determine them?

I. Definitions of terms for engines:

A. Stroke - distance piston travels from TDC (HDC) to BDC (CDC)

TDC = Top Dead Center
HDC = Head Dead Center
BDC = Bottom Dead Center
CDC = Crank Dead Center

B. Crank throw

= 1/2 of stroke

C. Bore - diameter of cylinder (not piston)

D. Piston displacement - volume displaced by 1 stroke of the piston

$$D_p = \frac{\pi \times B^2 \times S}{4}$$

for single cylinder engines
D_p = displacement
π = pi (3.14)
B = bore
S = stroke

E. Engine displacement for multi-cylinder engines - volume displaced by 1 stroke of all pistons

$$D_p = \frac{\pi \times B^2 \times S \times N}{4}$$ N = number of cylinders

Example - Displacement

1. 3" bore, 3" stroke, 1 cyl.

$$D_p = \frac{(3.14) \times (3^2) \times (3)}{4} = 21.1 \text{ in}^3$$

2. 3" bore, 4" stroke, 1 cyl.

$$D_p = \frac{(3.14) \times (3^2) \times (4)}{4} = 28.26 \text{ in.}^3$$

3. 2-stroke cycle engine, 1-cylinder
   2 x 1.75 (Note bore is always given first)

$$D_p = \underline{(3.14)} \times 1.75$$

$$D_p = 3.14 \times 1.75$$

$$D_p = 5.5 \text{ in.}^3$$

F. Piston speed - average speed of travel of a piston in feet per minute.

$$P.S. = \frac{S'' \times 2 \times RPM}{12}$$

P.S. = piston speed
RPM = revolutions per minute

$$P.S. = \frac{4 \times 2 \times 3000}{12} = 2000 \text{ ft./min.}$$

$$P.S. = \frac{3 \times 2 \times 3000}{12} = 1500 \text{ ft./min.}$$

ANSWER IS IN FEET/MINUTE.

G. Stroke - bore ratio - ratio of length of stroke to diameter of bore

S"/B" if it is 1 = referred to as a square engine

stroke $>$ bore = over square
stroke $<$ bore = under square

S = sroke, B = bore

H. Clearance volume = volume left when piston is at TDC and measured by liquid

I. Compression ratio = ratio of volume at BDC to TDC

1. $CR = \frac{D_p + C.V.}{C.V.} = \frac{7.5 + 1.5 = 6:1}{1.5}$

   CR = Compression ratio
   CV = Clearance volume

2. Displacement calculation if compression ratio and clearance volume are known.

   CR = 6 & C.V. = 1.5

   $6 = \frac{x + 1.5}{1.5}$ multiply out 1.5

   $9.0 = 1.5$ subtract out 1.5

   $7.5 = x$

Check work:

$$\text{Comp. R} = \frac{\text{Disp.} + \text{C.V.}}{\text{C.V.}}$$

$$\text{Comp. R} = \frac{7.5 + 1.5}{1.5}$$

Comp. R = 6:1

3. C.V. calculation if Displacement and compression ratio are known.

$$\text{CR} = \frac{\text{Disp.} + \text{C.V.}}{\text{C.V.}}$$

$6 = \frac{7.5 + x}{x}$ multiply both sides by x

$6x = 7.5 + x$ subtract 1x

$5x = 7.5$ divide by 5

$x = 1.5$

Example problem for compression ratio

2 bore 2 stroke & 1.5 in.^3 C.V.

$$D_p = \frac{(3.14)\ (2^2)\ (2)}{4} = 62.8\ \text{in.}^3$$

$$\text{CR} = \frac{6.25 + 1.5}{1.5} = 5.83{:}1$$

J. Valve speed - speed of valve operation

Valve duration or range:

i.e. $180^\circ + 45^\circ$ x $15^\circ = 240^\circ$ duration

$\frac{240}{360}$ = 2/3 of a revolution the valve is moving

$\frac{\text{60 sec./ min.}}{\text{3000 RPM}} = 1/50$ Acomplete revolution occurs in 1/50 of a second.

$2/3 \times 1/50 = 2/150 = 1/75$ A valve with a duration of 240° must open and close in 1/75 of a second.

Topic 7: Power Terms

Objectives

Upon completion of this lesson, the student will be able to:

1. Define power terms
2. Calculate corresponding problems

Materials

1. Calculator
2. Chalkboard

Introduction

1. Read from bulletin horsepower figures.
2. Are there different kinds of horsepower?
3. How can we determine them?

I. Introduction to power terms

   A. Define

      1. Energy - capacity or ability to work
      2. Force - action against an object that either tends to move the object from a state of rest or changes the direction or speed of an object already in motion

         *Force is given in pounds of pressure

      3. Work - force travels through a distance

         *Work = foot - pounds (Ft.#)
         = force x distance

      4. Torque - turning effort (measured in #Ft.)

         a. the effort that produces rotation or
         b. the effort that tends to produce rotation

      5. Power - is the rate (how fast) at which work is done

         $$\text{Power} = \frac{\text{work}}{\text{time}} \text{ or } \frac{\text{Ft.\#}}{\text{min.}}$$

      6. Horsepower - is the ability to do 33,000 ft.-lbs. of work in one minute

         $$1\ H_p = \frac{33{,}000\ \text{Ft.\#}}{1\ \text{min.}}$$

   B. Horsepowers:

      1. Indicated - (IH_p)
      2. Friction - (FH_p)
      3. Brake - (BH_p)
      4. Drawbar - (DH_p)
      5. PTO - (PTO H_p)
      6. Rated - (R H_p)

C. Computing brake horsepower

$$BH_p = \frac{2 \times \pi \times N \times T}{33{,}000}$$ One power stroke/2 revolutions of crank (4 stroke cycle engine)

N = RPM
T = Torque

Example problem for Brake Horsepower:

Engines produce 8 Ft.# of torque at 3600 RPM

$$BH_p = \frac{2 \times 3.14 \times 3600 \times 8}{33{,}000}$$

$BH_p = 5.48$

D. Engine factors which effect horsepower

1. Size of piston (area) } --displacement
2. Length of stroke }
3. Pressure on the piston
4. RPM
5. No. of cylinders

Topic 8: Magneto Ignition

Objectives

Upon completion of this lesson, the students will be able to:

1. Identify components of the magneto ignition system (M.I.S.)
2. Describe how the electricity is generated and dissipated in magneto ignition systems
3. Describe the function of each part in a M.I.S.
4. Identify the components and describe their function of a battery
5. Explain the energy
6. Explain safety rules and precautions necessary when working with batteries

Materials

1. Magnet and iron fillings
2. Cutaway of M.I.S. coil
3. Cutaway of condenser
4. Microampere meter and 2 magnets
5. Cutaway of battery
6. Transparencies

Introduction

1. How is the electricity produced in a magneto ignition system?

I. Small engine magneto ignition system

A. Purpose of ignition system - ignite the air-fuel mixture by means of a high voltage spark

B. The magneto ignition system

   1. Types

      a. Flywheel type - built in around the flywheel
      b. External type - self-contained, mounted externally

C. How can magnetism generate electricity

   1. Power decreases as you get away from the N & S poles of magnet
   2. Magnetic lines of force have direction - N & S
   3. Faraday found magnets could produce electricity

      a. As a magnet is moved past a closed-loop conductor (coil), electrical current will flow through that conductor
      b. The magnets must rotate past; if the magnet is stopped, the current will stop
      c. The current is produced by the magnetic lines of force in the closed-loop (coil) by induction (similar to induced current in an AC Arc Welder).

d. Amount of current produced depends on the following:

1. the strength of magnet.
2. the speed of the magnets moving by the closed loop (coil) conductor.
3. the size or number of turns of the conductor (coil).

D. Principles of magnetoignition systems

1. First Principle - current flows only when magnetic lines of force are cut by a closed-loop conductor (coil)

2. Second Principle - a magnetic field is produced when electrons flow through a closed-loop conductor (a magnetic field is produced around the coil of wire)

3. Third Principle - (transformer) voltage may be increased or decreased by mutual induction

Transformer consists of 2 conductors - insulated from each other and wound around a soft metal core. These are referred to as primary winding, and secondary winding in the coil (transformer).

a. The primary winding - is wound around the soft metal core and is known as the primary circuit; the soft metal core concentrates the magnetic field and thus the electric flow in the primary circuit.

b. Secondary circuit - is wound around the primary and is insulated from it. The alternating current builds up and collapses the magnetic lines of force with each alternation of current. Each time the current alternates the magnetic lines of force cut the primary circuit of the primary coil as they are built up and collapsed resulting in voltage and current flow because of the first principle, current flows when magnetic lines of force are cut by a closed-loop conductor.

E. Components

1. Magnets - embedded in flywheel (provide strong magnetic lines of force to induce current in the primary circuit)

2. Coil - induced current in the primary circuit is transformed (stepped-up) in voltage because the primary circuit has few windings and the secondary circuit has many windings (60:1 ratio).

a. Primary windings - a few hundred turns of relatively heavy wire

b. Secondary windings - many thousands of turns of fine wire

Step-up is from approximately 200 volts to 12,000 volts (60:1 ratio) between primary and secondary circuits

3. Armature - main function - to concentrate the magnetic lines of force

a. Laminated and insulated to avoid eddy currents (extraneous lines of current) from occurring in the armature

Eddy currents produce heat and oppose the reversal of the magnetic lines of force.

4. Breaker Points - complete the electrical path in the primary circuit-connected in series in the primary circuit (made of a tungsten alloy).

   a. When spark is desired, the points are opened this causes the primary circuit to stop flowing which causes a collapse of the magnetic lines of force. This rapid collapse of the magnetic field induces the high voltage necessary in the secondary circuit because its magnetic lines of force are cut by the secondary windings.

5. Condenser - absorbs current surge in circuit primary; electrical storage chamber connected in parallel with the points. Current can flow here when points open thus reducing arcing of the points and adding to point life.

   NOTE: Arcing causes two things:

   1. Burned and pitted points
   2. Prevention of rapid collapse of the magnetic field to induce high voltage in the secondary circuit

   Principle Two - speed of cutting magnetic lines of force is important; therefore, there rapid collapse of the magnetic field in the primary circuit in order to have an induction into the secondary circuit.

   Condensers are made of wound together metal foil insulated by paper. One strip of foil is ground the other connected to the primary circuit in parallel with the breaker points.

   Improper condenser capacity cause a: (1) weak spark and (2) pitting of the points

   (Refer to page 17 of General Theories - B & S.)

6. High Tension Lead - provides a path for high voltage to travel from coil to spark plug

7. Spark Plug

   a. Too hot of plug - electrode burns and erodes away

   b. Too cold of plug - the plug may oil and carbon fowl

   Follow manufacturer's recommendations for plug heat range.

F. Magneto Cycle for a Z-legged Armature

1. When the magnets start to align with both legs of the armature, magnetic lines of force flow through the armature. Voltage and current are induced in the primary circuit because the breaker points are closed and the circuit is complete making the primary circuit an electro-magnet.

2. No current flows through the secondary circuit because it is open at the spark plug gap.

3. The flywheel continues to rotate causing the magnetic lines of force to flow in the opposite direction in the legs of the armature. This reversal of magnetic lines of

force causes the magnetic lines of force to jump across the air gap at the top of the armature. It is at this point that the magnetic lines of force are greatest and the highest voltage is produced, which is approximately 200 volts in the primary circuit.

4. Now the flywheel has turned a few more degrees. At this position the breaker points open which halts the current flow in the primary circuit and built-up magnetic forces suddenly reverse and rapidly collapse cutting the turns of coil in the secondary coil.

5. This sudden and rapid collapse of the magnetic field generates or induces a high voltage in the secondary coil of approximately 12,000 volts which is enough to jump the spark plug gap thus producing an ignition spark.

G. Spark timing is important - the flywheel key must be in good condition or timing will be off causing:

1. Backfire
2. Hard to start
3. Or not start at all
4. Spark will be low because peak of magnetic field is past

H. Summary - steps in magneto cycle

1. Magnet produces magnetic field
2. Magnetic lines of force flow through the armature
3. Current induced in primary circuit
4. Magnetic lines of force reverse and voltage reaches peak in primary circuit (200 volts).
5. Points open
6. Current in primary circuit stops
7. Condenser absorbs primary circuit surge
8. Magnetic field collapses
9. High voltage induced in secondary circuit
10. Spark plug fires air-fuel mixture - starting power stroke

I. Cause of faulty ignition:

1. Incorrect air gap between flywheel and armature
2. Worn bearing or shaft on flywheel side
3. Sheared flywheel key
4. Incorrect breaker point gap
5. Defective (dirty or worn) breaker points
6. Breaker point plunger stuck or worn
7. Shorted ground wire (if so equipped)
8. Shorted stop switch (if so equipped)
9. Faulty condenser

10. Faulty coil
11. Loose or grounded high tension lead

Topic 9: Solid State Ignition Systems & Spark Plugs

Objectives

Upon completion of this lesson, the student will be able to:

1. Identify components and functions for the solid state ignition system
2. Describe how the electricity is produced and how the spark is timed
3. Identify components and functions of the tractor ignition systems
4. Describe commonalities and differences between tractor ignition system operation and maintenance and magneto ignition system operation and maintenance
5. Identify parts and function of spark plugs
6. Read problems from spark plugs

Materials

1. Old spark plugs
2. Spark plug chart
3. Transparencies

Introduction

1. Many new engines have solid state ignition systems
    a. What is it?
    b. How does it work?
    c. Is there any advantage over standard systems?

I. Similarities between magneto ignition system (M.I.S.) and solid state ignition system (S.S.I.S.)
    A. Current generated in a coil
    B. Current generated by a magnet on a flywheel

II. Differences between M.I.S. & S.S.I.S
    A. Current directed through diode rectifier where it is changed from A.C. to D.C.
    B. D.C. current stored in a capacitor
    C. Transistorized electrical switch replaces the breaker points.
        1. If it were a mechanical device, it would block the current from the capacitor with a main gate until it was needed, when needed, a second gate would be opened by a small current flow, enough to unlatch the main gate so the capacitor charge would be released. Once the charge is spent, the gates return to the closed position.
    D. The current remains stored in the capacitor until the flywheel rotates one-half turn. (Same magnetic provides main - stored current - and current for triggering the transistorized switch).

E. Current leaves the capacitor to the ignition coil where it is stepped up enough to jump the gap at the spark plug

(Step up from 200 to 12,000. 60:1 ratio in step up transformer).

III. Spark plug - provides gap for the current to jump which ignites the air-fuel mixture

A. Parts

1. Reach - length of thread portion; varies 3/8 to 3/4 depending on head design

2. Heat range - determined by length of ceramic insulator

B. Reading engine problems from the spark plug (get a Champion Spark Plug Chart from your auto parts store).

Topic 10: Carburetion

Objectives

Upon completion of this lesson, the student will be able to:

1. Identify parts and function of components of carburetor
2. Explain air fuel ratio
3. Describe functional differences of Briggs' 3 types of carburetors
4. Identify basic systems and functions
5. Chart air and fuel at various speeds of operation

Materials

1. Three carburetors
2. Transparencies

Introduction

1. How might we meter fuel so we have the correct air-fuel ratio under varying operation conditions?
2. Show different carburetors.

I. Carburetion

   A. Function - provide correctly proportioned, air-fuel ratio, to the cylinder.

   B. Idle air-fuel mixture (14-15 to 1) -

   C. Lean mixture causes -

      1. overheating
      2. detonation
      3. short valve life
      4. rough erotic operation
      5. lower h_p output

   D. Rich mixture causes -

      1. pollution (hydrocarbons & CO)
      2. wastes fuel
      3. fouls spark plugs
      4. leaves carbon deposits on combustion chamber parts
      5. raw fuel washes past rings

         a. wear rings and cylinder
         b. dilute oil causing wear in bearings

   E. Three types of carbs on Briggs engines -

      1. gravity system flo-jet:

         a. needle valve and seat
         b. fuel bowl and float
         c. air bleed
         d. idle system
         e. updraft design

2. pump system:
    a. diaphram pumps fuel to small storage area (pulse from intake stroke) - fuel chamber -
    b. side draft design
3. suction system vacu-jet:
    a. draws fuel directly out of tank (shallow tank required)
    b. side draft design

F. Systems and functions - float carbs -

1. float
2. choke
3. high speed
4. idle
5. throttle

G. Carb parts Id and individual part function -

1. throttle
2. air bleed
3. fuel inlet
4. float needle valve and seat
5. venturi
6. float
7. needle valve - main jet
8. air horn
9. choke
10. discharge tube and orifices
11. bowl vent
12. idle valve
13. discharge slot

H. Fuel and air flow in carb within -

1. choke system
2. idle system
3. high speed system
    a. air bleed functions only in high speed - lean mixture - not enough draw to operate it at other times.

I. Carb adjustment -

1. main jet needle valve first - as main changes so changes idle potential
    a. starting point 1 1/2 turns off seat
    b. adjust to lean - then rich - set at midpoint
2. Idle jet adjustment
    a. starting point 3/4 turn off seat
    b. adjust to lean - then rich - set at midpoint

Topic 11: Fuels

Objectives

Upon completion of this lesson, the students will be able to:

1. Identify types of fuels
2. Describe qualities of various fuels
3. List advantages and disadvantages of various fuels
4. Explain detonation and dieseling and the causes and effects
5. Explain storage requirements of various fuels

Materials

1. Safety fuel storage can

Introduction

1. Upon engine disassembly in lab of your engines, we noticed odd smells of fuel and rust in tanks; what causes this?
2. What's the power difference between gasoline, diesel and LP?

I. Three main fuels

- A. Gasoline - C_8H_{18} (octane) C_7H_{16} (heptane)
- B. Diesel - $C_{16}H_{34}$ (cetane)
- C. LP - gas - C_3H_8 (propane) C_4H_{10} (butane)

II. All fuels refined from crude oil

III. High quality fuels are needed to prevent:

- A. Dentonation, pinging, engine knock - explosion of gases ahead of flame after fuel has been ignited (opposite spark plug)
- B. Preignition - ignition of fuel before spark
- C. Causes of knock:
  - a. low octane fuel
  - b. combustion chamber deposits
  - c. cooling system failure - hot engine
  - d. carburetor - too lean
  - e. spark setting - too advanced
  - f. wrong or damaged plug (heat range)
  - g. temperature of air-fuel mix too high

IV. Compression ratio varies with fuel

Kerosene (distillate) - 4 to 1
Regular gasoline - 7 to 1 -- 8 1/2 to 1
LP gas - 8 1/2 to 1 -- 10 to 1
Diesel 1 14 to 1 -- 23 to 1

V. Fuel quality

- A. Fuel must be clean - water, rust and dirt can be trapped in filters.
- B. Octane rating - measure of tendency to resist detonation (resist self-ignition).

C. Starting - for easy starting you need good fuel vaporization

1. Why - gasolines are blended for summer and winter use (winter blend has higher percent of light vaporizing fuels; never keep gas longer than 30 days)

D. Burning (gas should burn evenly - no explosions) Explosion are the pinging noise heard when octane level is too low, these explosions will damage valves and pistons.

VI. Diesel fuel grades

A. Cetane - self-ignition and burning qualities - the higher the cetane number the easier it self-ignites (opposite of octane)

B. No. - 1 Diesel - use in high-speed engines in service involving frequent and relatively wide variations in load and speed and also where abnormally low fuel temperatures are encountered (cold weather - lighter fuel - less BTU's)

No. - 2 Diesel - lower vitality, use high-speed engines in services involving relatively high loads and uniform speeds or in engines not requiring properties of No. -1 Diesel; heavier - requires warm temperatures for good starting (above 20°F.) more BTU's/gal.

C. Summary

No. - 1D = cetane 52, for cold weather, less impurities and easy starting

No. - 2D = cetane 50, for summer use, high viscosity - better lub, for injections and cheaper

D. Special considerations for diesel fuel

1. Sulfur - a special problem with diesel fuels
2. sulfur + water = acid
3. Water settles out very slowly (storage for long periods a problem)
4. H_2O + injectors = trouble (rust)
5. Dirt is a major problem for injector internal parts where clearances are in millionths of an in. - nozzle .001 - pressure 3000 psi +

VII. Operating characteristics of modern engines

A. Gas

1. Compression pressure - 70-160 psi
2. Ignition temperature - 3500-4000° F.
3. Exhaust temperature - 1700-2000° F.

B. Diesel

1. Compression pressure - 500 psi
2. Ignition temperature - 3000-3500° F.
3. Exhaust temperature - 1400-1500° F.

VIII. Fuel storage

A. Never store fuel in tanks on engines for long periods of time - gum deposits, varnish, water condensation and rust.

B. Fuel loses quality over time; buy what you will use in

1 month

a. below ground storage = lose little fuel because of low temperature.
b. above ground storage = lose volatiles out of fuels which makes engines hard starting.

C. Storage

1. Protection of fuel quality - protected area from sun and rain (vaporization and water).

2. Safety dictates the fuel storage be at least 40' from buildings for above ground storage.

D. Summary for storage of gasoline - If you install an underground tank:

1. Fuel evaporation is not a serious problem
2. Little tendency for water accumulation condensation in the tank
3. Gum - depositing tendency slowed
4. Fire hazard reduced (tank can be 1 ft. from building)
5. Tank is hidden - not junky looking

If you install an above ground tank:

1. Cost is less
2. Ground water and limited flooding have little effect
3. It is easily moved
4. Easily cleaned
5. Lower replacement cost

E. Diesel storage and handling summary

1. Don't use an open container to transfer fuel
2. Don't store diesel in a galvanized tank - powdery particles
3. Don't use a tank that formerly had gasoline in it (rust and dirty picked up)
4. Don't let the pick-up pipe in the storage tank extend to bottom of the tank (3-4 above)
5. Drain and clean twice a year

Topic 12: Air Cleaners & Governors

Objectives

Upon completion of this lesson, the student will be able to:

1. Identify various air cleaners and governors
2. Explain how each works
3. Describe advantages and disadvantages of each

Materials

1. Paper air filter demonstration model
2. Oil bath air cleaner demonstration model
3. Several different types of air cleaners taken from small engines

Introduction

1. What kind of air cleaner do you have on your car?
2. Is it the best kind?
3. Demonstrate model air cleaners.

I. Types
   - A. Oiled polyurathane foam
   - B. Oil bath
   - C. Dry paper element
   - D. Centrifugal

II. 3H$_p$ engine operating at 3600 RPM uses about 390 cu. ft. of air an hour entering at the rate of about 24 miles per hour. Generally operations are dusty and dirty.

III. Dirt gets into engine
   - A. If it doesn't have an air cleaner
   - B. If air cleaner is not functioning correctly

IV. Dirt action in cylinder
   - A. Some gets blown out through muffler
   - B. Some adheres to the cylinder where it creates ring and cylinder wear.
   - C. Some works down the walls into the crankcase where it causes wear on all lubricated moving parts

V. Function
   - A. Dry paper element - is superior in its cleaning ability
   - B. Dry inertia - has a cyclone action and forces the dirt out by centrifugal force (works on large particles)
   - C. Oil saturated - polyurathane foam causes well and requires service regularly
   - D. Oil bath - doesn't clean as well as foam or dry element - must service frequently

E. Recommend using two filters in tandem in dusty conditions

F. Filter must be designed for engine

Part 2

Governors

I. Main function - governor maintains constant engine RPM

   A. Air vane - wind velocity from flywheel on vane causes an opening or closing of the throttle (carb) in order to maintain engine's speed

   B. Flyweights - flyweights acted on by centrifugal force cause throttle (carb) settings to change which maintain constant engine RPM

   C. Governor action tends to slow engine

   D. Throttle action tends to speed up engine

Topic 13: Cooling Systems

Objectives

1. Identify various cooling systems
2. Describe how they work
3. Explain the importance of holding correct heat
4. Explain how coolant materials react in systems
5. Explain the importance of pressurization
6. Explain proper maintenance

Materials

1. Antifreeze can
2. Transparencies
3. Air-cooled engine with shroud off

Introduction

1. Have you ever had an engine quit on you because of overheating?
2. Air-cooled engine - cooling fins

I. Engine Cooling

- A. Function:
  1. Remove excessive heat
  2. Prevent overcooling
  3. Maintain constant operating temperature
- B. Process Involved:
  1. Absorption of heat
  2. Circulation of coolant
  3. Radiation of heat to air
  4. Temperature control
- C. Effects of Engine Overheating
  1. Burning of valves
  2. Engine ping or knock
  3. Vapor lock
  4. Increased wear due to poor lubrication
  5. Sticking valves and lifters
  6. Localized hot spots
  7. Possible cracking of engine head or block
  8. Scuffing and scoring of cylinder walls
- D. Methods of cooling engines
  1. Air - air cooled
     - a. Means of directing air at high velocity over cooling

fins

b. Cooling fins and shroud must be kept clean (oil & dirt)

c. Air-cooled engines run hotter than water-cooled engines

(1) Better combustion and utilization of fuel

(2) Harder on components

(a) Valves
(b) Piston and rings
(c) Bearing

(3) Crankcase oil assumes more of a cooling roll

(4) Oil fatigue may result

2. Water cooled

a. Water - antifreeze mix allows engine to run 220-240°F.

(1) Better fuel utilization than at 180°F. of days past

(2) Cooling system must be clean (rust)

(3) Flush each 2 years

(4) Oil important to engine cooling as well as lubrication for both air-cooled and water cooled engines

E. Water-Cooled Systems

1. Pressurized system with coolant

a. Pressure allows:

(1) Coolant to move more uniformly

(2) Coolant to operate at higher temperature without evaporation lose or boil over (for each pound of pressure, the boiling point is raised 3°F.).

b. Coolant

(1) Allows cold weather nonfreeze character
(2) Permits - engine to run warmer and more efficiently
(3) Has better cooling characteristics than water
(4) Has higher boiling point than water

F. Thermostats

1. Allows engine to warm to predetermined temperature more rapidly (stay closed - no circulation)

2. Allows engine to maintain consistent operating temperature in varying environmental temperatures (amount of opening)

3. Allows engine to cool more slowly (open for thermo-siphon when hot - close to maintain heat in engine below 190° F.)

G. Testing Thermostat

1. Place in water with thermometer
2. Bring temperature of water up slowly

3. 180° thermostat starts to open at 160°F.
4. 190° thermostat starts to open at 170°F.

H. Pressurized Radiator Cap

1. Test with air pressure when radiator is removed
2. If gasket or other parts bad, replace
3. Do not change to pressure cap of differing pressure on a given system
4. Do not overfill system

I. Freezing Points of Water - Antifreeze Solutions

%AF	Freeze Point
0	32
20	15
40	-15
50	-35
60	-60
70	-58
90	-30
100	0

J. Boiling Points of Water - Antifreeze Solutions

%AF	Boiling Point
0	212
20	218
40	225
60	235
80	255
100	330

Topic 14: Lubrication

Objectives

Upon completion of this lesson, the student will be able to:

1. Identify oil characteristics (i.e. viscosity, service rating. types and additives)
2. Explain the function of the above
3. List new service rating and describe correct application
4. Explain polymers
5. Explain severe use conditions
6. Describe function of oil
7. Explain proper storage of oil

Materials

1. Oil samples
2. Oil cans

Introduction

1. Set different oil cans on desk, say "which is best".

A. Purpose of Lubricants

   1. Reduce friction
   2. Reduce wear
   3. Cool
   4. Seal rings
   5. Clean bearing and all parts
   6. Reduce corrosion - rust and acids
   7. Must do above under varying conditions
      a. Must remain fluid when cold
      b. Retain enough body to reduce friction when hot

B. Types of Lubricants

   1. Crankcase oils
   2. Gear oils
   3. Hydraulic oils
   4. Lubricating greases

   5. Viscosity - Fluidity - Flow rate (easy flow - low viscosity number)
      (hard flow - high viscosity number)

   Measured at

   Winter - 0°F
   Summer - 210°F.

6. Grades

SAE Number 5 w
10 w
20 w
20 crankcase oils
30
40
50

7. Multiple Viscosity Oils

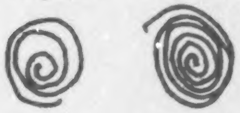
SAE Number 5 w - 20
10 w - 30
20 w - 40
10 w - 40

obtained by addition of viscosity index improver polymer

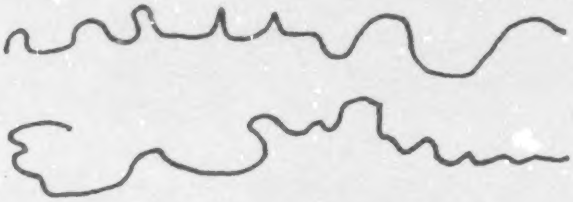
8. Principle of How Multi-Viscosity Performs

Polymer's unwind as the oil is heated

Polymer's when cold- they remain tightly wound and resist movement.



Polymer's when hot- unwind and move easily.



9. Service classification of oils

SA - Gasoline engine light duty use only (mineral oil - no additives)
SB - Gasoline engine moderate use only, presents problems with deposits and bearing-corrosion when crankcase oil temperatures are high.
SC, SD, & SE - Gasoline engines used under favorable or severe conditions (small gasoline engines, air-cooled). Additives help protect against deposits, wear and bearing corrosion.

C. Lubrication Systems (crankcase)

1. Pump - detergent - dispersent

2. Splash - antifoaming agents important

D. Severe use conditions (SE oil)

1. Frequent starting and stopping
2. Prolonged idling
3. Light loads, especially in cold water
4. Heavy-duty work requiring high engine output at high air temperature
5. Diesel same except add sulfur content of fuel more than 0.5%

Topic 15: Storage & Trouble Shooting

Objectives

Upon completion of this unit, the student will be able to:

1. Properly prepare an engine for storage.
2. Describe correct maintenance time on various engine parts (i.e. change crankcase oil, air cleaner, etc.).
3. Explain basic trouble-shooting technique.

Materials

B & S Engine Maintenance Guide

Introduction

1. How often do you change your lawn mower crankcase oil?

A. Storage of Small Gasoline Engines
    1. Drain fuel tank and carburetor; let engine run fuel out of system.
    2. Drain oil, flush with kerosene and refill with proper oil (30w).
    3. Clean exterior of engine (especially cooling fins).
    4. Service air cleaner.
    5. Spread light film of oil over exposed surfaces subject to rust.
    6. Remove, clean and regap spark plugs.
    7. Put tablespoon of oil into spark plug hole, crank engine by hand and replace plug.
    8. Store engine in dry place.

B. Trouble-Shooting

Replacement of parts or pieces is a relatively easy job for anybody who can use common hand tools. The mark of an expert; however, is an individual who can quickly determine why an engine will not start or will not perform properly.

The best and proven method of quickly determining any cause of engine malfunction is to develop the use of a regular Trouble-Shooting procedure that will enable you to analyze the cause, so you can then effect a cure.

Such a procedure, to be of value, must help you to quickly spot what is wrong, analyze the cause of possible future trouble, and save time while making the repairs.

First Five Minutes.

In most cases, you should be able to trouble-shoot an engine in less than five minutes. As a result of your diagnosis you should have a very good idea of what parts are needed and how long it would take you to make the repairs.

Your diagnosis or analyzing of the engine will enable you to check out the ignition, carburetion and the compression systems. Since engine operation is also in many cases affected by the equipment it powers, you will in these instances also check out the equipment.

Equipment Affects Engine Operation.

Some equipment problems are quite obvious. A loose belt causing slippage could appear to be an engine power loss. Tight drive gears could create a drag that also would indicate an engine power loss.

Probably, the most common example of how a part of the equipment can affect the engine operation is the cutter blade of a rotary mower. A loose blade may create a kick-back that will cause hard-starting, or prevent starting.

An out-of-balance blade may cause destructive vibration. Since a very common engine application is the rotary mower, we will use a rotary mower to demonstrate checking of the engine and the equipment it powers.

Repair-Replace?

The first, or initial inspection of the engine, before any repairs are attempted, should enable you to determine the general area or areas of malfunction. Remember, there may be more than one thing wrong with an engine. You should also be able to determine if the engine is badly worn to the point where it would not be economical to repair it. In some cases, it may be better to use a short block assembly or replace the complete engine.

Use Slides To Illustrate.

Since the engines brought in for repair will obviously vary by engine model, that will be equipped with various types of carburetors and governor controls, we will use slides to illustrate what to watch for while performing a diagnosis of the most popular engine models. Remember, that the step-by-step procedure of our trouble-shooting will vary according to engine model. The point I would like you to keep in mind is that a procedure should be followed to enable you to determine with a minimum amount of time involved what repairs may be necessary, at the moment, what may be necessary in the near future.

After running through our trouble-shooting procedure, we will go into further detail as to what to look for, if, for example, the engine did not have spark, was not getting fuel into the combustion chamber, did not have compression, etc.

Check Oil Level.

The first step in your procedure should be to check the crankcase oil level. Obviously, if the engine did not have oil in it and you started it, the engine could be damaged internally. In addition, the level of the oil and its condition can be a guide to you as to what you may expect to find when you get further into the engine.

A very low oil level could indicate the possibility of scoring of the internal parts, such as the crankshaft, connecting rod, and/or the main bearings. Very dirty oil could be an indication of excessive internal engine wear.

Some engines are equipped with an extended oil fill and dipstick. Where so equipped, be careful that the sump or crankcase is not overfilled with oil as excessive oil will cause smoking condition.

Also, where so equipped, be sure there is a proper seal between the tube and the sump or cylinder, and also that the upper end of the dip stick is sealed, or if not there can be a loss of crankcase vacuum, and it is sure to smoke through the muffler.

Check Air Cleaner.

Since the purpose of the air cleaner is to trap incoming dirt, it may be somewhat dirty. If it is of the oil foam type, the dirt; however, should be on the bottom portion of the element where the entry holes are found in the bottom part of the air cleaning housing. There should be no dirt shown on the top part of the element, but should be clean as indicated in this slide.

Dirt at the top part of the element is generally an indication that the element has been cleaned but not reoiled. When this happens, dirt can go right through the element and enter the engine.

Proper servicing of this oil foam air cleaner element is important and the Repair Instructions cover how to clean and reoil.

If the filler has been serviced and thereby functioning properly, it has been protecting the engine from dirt. If not, and there are indications of dirt getting through or by the filter, you may again suspect internal engine wear.

Also inspect the air cleaner mounting gaskets, to be sure they are sealing against dirty entry. A gasket that is torn or deformed should be replaced.

Check Remote Controls.

With the air cleaner off, you should check the remote choke and stop control, if the engine is so equipped. Here is a typical control of this type. These controls can get out of adjustment or possibly misadjusted by the owner. They can also get rusty or bind, due to getting kinked out of shape. There is the possibility the engine did not start simply because the choke was not fully closed at the carburetor even though it indicated "Choke" at the control level.

Check by moving the control lever to the full "Choke" or "Starting" position and make sure the choke at the carburetor fully closes. Move to the "Stop" position and make sure the stop switch contact is made. Should the control lever at the carburetor move slowly, binding could also occur here due to rust or grit.

Some small Briggs & Stratton vertical shaft engines are equipped with an automatic choke which is controlled by intake manifold vaccum.

With the air cleaner off and the engine not running, the choke plate should be in the "closed" position.

When the engine runs, vacuum holds the choke in an "Open" position. The choke will close again as soon as the engine is stopped.

Some engines are equipped with a Pulsa Jet Carburetor. This type of carburetor incorporates a built-in fuel pump actuated by intake manifold pulsation. When so equipped, the air cleaner stud should be put back into place, or gas from the fuel cup, mounted under the carburetor, may enter the carburetor through the air cleaner stud hole.

Dry Spark Plug.

Be sure you do not overlook the obvious. Make sure there is gasoline in the tank and that it is gas and not kerosene, or some other such substance. Also see that the gas is not stale. Stale gas is recognizable by the stong smell.

Watch for use of the wrong seasonal grade of fuel. If the engine on a snowblower won't start, it may be because Summer Grade of gasoline is being used. This Summer Grade may not properly vaporize in cold weather.

The reverse may be true if a Winter Grade gasoline is used in a mower. The engine would probably start all right but may quit after some few minutes of operation, due to a form of vapor lock in the fuel system.

Unfortunately, there is no easy way of recognizing the wrong seasonal grade of fuel. If in doubt, empty the tank, and use a fresh, clean Regular grade or unleaded fuel that has been purchased recently so it will be seasonably correct.

Since you have already tried to start the engine with a full choke, you could now remove the spark plug and take a look at it. If the plug is dry, it is most likely that no fuel, or very little fuel, is getting into the combustion chamber. We will later elaborate on what to look for if this condition was observed.

Wet Spark Plug.

Suppose you removed the plug and found it wet? If the electrodes were wet from gasoline, most likely the ignition system is faulty. If it was wet with droplets, you prbably will find water in the fuel system.

If you find later, while checking the ignition, that you have spark but the plug is wet, the fuel most likely is Summer Grade of gasoline being used during the Winter and is not vaporizing properly, as we mentioned before.

Another possibility is a VERY rich mixture that would literally choke out the engine and leave the plug wet.

If you suspect this condition, look in the air horn of the carburetor for signs of flooding.

Equipment Check.

Remember that we said the equipment itself could affect engine operation. If for example, the complaint was of hard starting or kickback, this would be a good time to check the blade to make sure it is securely fastened.

While inspecting under the deck rotate the crankshaft and cutter blade and check alignment with the deck. This will tip you off as to the possibility of a bent crankshaft or blade.

Also check for loose engine mounting bolts.

Check The Spark.

To check for spark, use the 19051 tester, as indicated in the right hand view. If the spark jumps the .166 tester gap, the engine has sufficient spark to start. Never check the ignition by grounding the spark plug and firing across the electrodes. A spark that would jump the .030 electrode gap at atmospheric pressure may not jump the same gap under the pressure built up in the combustion chamber. This is why the tester gap is .166". This gap, under atmospheric pressure, is approximately equal to the .030" gap under compression pressure.

Check Fuel System.

If you had found that the spark plug was dry, fuel was evidently not getting to the combustion chamber. It takes only a few seconds to confirm this.

Put a very small quantity of gasoline either into the spark plug hole or into the carburetor air horn. Replace the plug, crank the engine and if it fires a few times you will know most likely the trouble is in the fuel system.

If the engine did not fire you could probably eliminate the fuel system as the trouble source.

Check Compression.

When you tried to start the engine, you got an idea as to whether or not the engine had good compression. Chances are; however, that the Briggs & Stratton engines you work on will be equipped with the Easy Spin compression release. As you may know, this device allows some air to bleed out of the combustion chamber at cranking speed, thereby lowering compression resistance. This can fool you then when checking compression, if you spin the flywheel in the normal direction of rotation.

While you have the blower housing off, spin the flywheel in reverse or counterclockwise rotation, to check compression. This will eliminate the effect of the Easy Spin system, and give you a true compression check.

If compression is adequate, the flywheel should bounce back, as long as there is no belt load or other comparable drag on the engine. If compression was poor, it is probably ready for a valve job, or it could be rings. In any event, you know the engine requires more than just a checkup. Later, by removing the head, you could then determine the extent of the necessary repairs.

While making this check, examine the cooling fins for possible clogging which could cause overheating. Overspeeding could also result, in that the air which normally flows over the governor vane, and then over the cooling fins, may take reverse flow and blow against the back side of the governor blade, thereby opening the throttle and causing overspeeding. Even worse, the cooling fins being clogged, whether the engine has an air vane or a mechanical type governor, can result in overheating and seizure.

Check Bearings.

After checking the compression, move the flywheel up toward the armature and down away from it. This is to check for crankshaft and bearing wear, which could then indicate excessive internal engine wear.

If the shaft can be moved up and down appreciably, the armature air gap will noticably change. This would affect breaker point gap, which also changes as the shaft is moved up and down within the main bearings. What is even more important; however, is that if you can see any appreciable amount of wear; say .004" or more, it is quite likely that the rest of the engine is badly worn and it may not be worth while giving it a tuneup. At this point, you may be better off using a short block or installing a new engine. This again would tie in with what you have previously noted while making your diagnosis.

Note To Instructor.

The slides you have just used illustrate HOW to quickly check an engine for the cause of any possible malfunction of any or all parts of the Ignition, Carburetion and Compression systems, and, in some cases, the equipment powered by the engine.

It should be made clear that this is the initial checking to find any area of failure and the following slides go into details of how to inspect the engine, to determine exactly what is wrong, or the reason for the lack of carburetion, ignition, compression, etc.

Detailed Trouble-Shooting.

So that we can have an opportunity to completely check all aspects of this engine, we will assume that it did not have ignition, carburetion, or compression; therefore, we will go through further inspection of each of these systems to determine the EXACT reason for malfunction of any one of the systems.

Stop Switch Ground Wire.

In the event, for example, you did not have a spark on the earlier check, you might, where the engine is so equipped with remote stop switch, inspect the ground wire and its connections to make sure it is not shorted out. There probably are quite a few engines which have had the ignition system worked over because there was no spark, only to find out later that the ground wire was shorted. If in doubt, disconnect the ground wire at the top switch clip.

Armature Air Gap.

Here is another possible cause of ignition problems. Remember when we checked the armature air gap? If the armature air gap is too large it could require excessively fast cranking to deliver enough voltage to the plug to start and run the engine. While, on the other hand, if there is a complaint of kickback it could be the air gap is too small. This could cause a tendency to backfire when cranking the engine over very slowly. Remember, the spark occurs at the plug before the piston reaches top dead center. Under very slowly cranking RPM there is not enough flywheel momentum to carry it past that point. The spark could ignite the mixture in the combustion chamber and drive the piston down reversing the direction of the crankshaft.

Kickback can also occur when starting an engine, equipped with a lightweight flywheel, if the cutter blade is too loose or has been removed. As you know, in this case the cutter blade also functions as a form of flywheel.

Check Keyways.

When you remove the flywheel to get at the breaker points, make sure that the keyways in the crankshaft and flywheel are not damaged. The use of a hard steel key can result in damage to the flywheel and/or crankshaft keyway. The reason Briggs & Strattom uses a soft flywheel is that it serves the same purpose as a shear pin in an outboard motor, that is, so that in event of a sudden seizure or stopage of the crankshaft the soft key will be sheared without damaging the more expensive parts, such as the crankshaft and/or the flywheel.

Sheared Key - Lowered Voltage.

Take a look at the key to see that it has not been sheared. Even a slight shearing of the flywheel key will result in a lowering of the voltage delivered to the spark plug. Proper voltage to the plug can only occur when the flywheel pole pieces pass the armature laminations at the exact moment the breaker points open. This can only occur when the flywheel key is undamaged.

A slight shearing of the key, as indicated in this slide, will result in a reduced voltage output to the sparkplug.

Remember when we used our 19051 tester, rather than grounding the spark plug and checking spark across the electrodes?

The reason we did this was to make a complete check and make sure we are getting sufficient voltage to the spark plug. If the spark jumped the tester gap of .166" we knew we had sufficient spark.

Dust Cover - Oil

With the flywheel removed, inspect the dust cover. If the cover is oily the oil seal is probably leaking and should be replaced. If your earlier check of armature air gap showed crankshaft and/or bearing wear, the seal may be okay but could not control the excessive play between shaft and bearing. Here again, the results of your checking various sections or parts of the engine will collectively give you a complete story of that engine's condition.

Dust Cover - Seal.

When you remove the breaker point dust cover and find the area under the cover is sooty and dirty, you had better check further and do more than just replace the breaker points. Dirt, grit, or oil may be entering due to poor fit of the cover. Whatever the reason, this dirt or oil entry must be corrected, otherwise a new set of points will not last very long and you will end up putting on another set of points.

If the dust cover is relatively clean on the outside and sooty or oily on the inside, the breaker point plunger and plunger hole may be worn. We will check that next, but be sure to replace a damaged cover and put a sealer, such as Permatex at the point where the coil lead enters under the cover.

Check Breaker Plunger.

Check that the plunger is installed correctly. The beveled edge in the center area should be down. If installed correctly, the groove at the top of the plunger will be visible when the plunger is installed. If put in upside down, the plunger will pump oil up into the breaker point area.

If the plunger is worn to a length of .870 inch, or less, it must be replaced or it will be impossible to achieve proper spark timing.

If in doubt, replace. Remember on small aluminum cylinder engines you can use Kit #299061. This kit contains the flywheel key, breaker points and plunger.

Check Plunger Hole.

After you remove the old points, and before replacing the new set, use a #19055 plug gauge and check the plunger hole for wear. If the gauge enters 1/4" or more, you will have to plan on rebushing the plunger hole. If not, oil may work out the plunger hole and shorten breaker point life. Here again, oil around the area of the plunger hole will be a tip-off as to possible plunger hole wear. The plug gauge and other tools we will be using are illustrated in the Repair Instructions.

Breaker Point Gap.

Incorrect breaker point gap will affect spark timing. Kickback can occur due to advanced timing if the breaker point gap is too wide. Loss of power can occur if the breaker point gap is too close as this will retard the spark. Be sure that the gap is set at exactly .20.

Here is how the wrong breaker point gap can affect spark timing. When the points are closed, there must be some clearance between the point arm and the point plunger. If the points are set too wide, the clearance between arm and plunger will be less than normal. When the crankshaft revolves the plunger will therefore have less distance to travel before lifting the point arm and causing the breaker points to open.

The points will open earlier and spark timing will be advanced.

If the point gap is too small, the opposite will occur and spark will be retarded.

Running Ignition Check.

Let us assume that when the engine was brought in to you that it ran but it seemed to miss and lack power. A running check can be made by starting the engine, slipping the ignition cable off of the spark plug and then inserting the 19051 tester into position between the plug and cable.

If the spark is steady while the engine is running, any miss is probably something other than ignition. If the engine misses due to the failure of the ignition system, it will be quite apparent while watching the spark jump at the tester.

You will note that there is a .008" gap between two of the tester points - this additional, or third point, is put in to keep the tester correctly calibrated.

When using this tester, the cable must always be connected as indicated where the two adjusting screws are at the top of the tester and the one adjusting screw at the bottom with the lead from there to the spark plug or ground.

Remove Control Adjustment.

Assuming that your initial check indicated the remote control on a Choke-A-Matic carburetor was installed incorrectly, your adjustments are made as follows:

First of all, move the remote control lever on the equipment to the "FAST" or HIGH speed position. Make sure that the control lever assembly is installed and not loose, as this could affect its operation due to the clearance between the wire and its casing.

The lever on the carburetor should just be touching the choke arm when the remote control lever is in the FAST position. If not, loosen the casing clamp and screw on the blower housing and move the control casing forward or backward until the correct position is obtained, after which the casing clamp screw would be tightened.

Check the choke and stop position. If you cannot get a full travel check for travel of the remote control wire, as this should be minimum length as illustrated.

If the engine is equipped with an Automatic Choke you can adjust the Remote Control by loosening the casing clamp screw and placing the remote control lever in the FAST position.

Next move the control casing forward or backward until the carburetor lever just touches the boss, which is the small plastic stop switch holding the stop switch blade. The casing clamp screw should then be retightened.

Wet Spark Plug.

Remember when we checked the spark plug earlier and found that the plug could have been wet? We mentioned that it could be wet from gasoline, and you could ordinarily smell this, or notice that the liquid, or damp part of the plug would tend to flow more in the nature that oil would do.

If, on the other hand, you found droplets, this was probably water in the tank or carburetor. Water being heavier than gasoline will lay in the bottom of the tank, or the carburetor bowl, and will be picked up by the carburetor nozzle on fuel pipe. It would be necessary then to clean out the tank and the carburetor, and also clean out the fuel line on flow type carburetors.

If the water had been in the fuel system for some time the resulting rust or corrosion may make it necessary to replace some parts. Make a careful inspection of the fuel system parts such as the tank, etc.

Dry Spark Plug.

If, when you had removed the spark plug earlier, you found it was dry this would be a good indication that the fuel was not getting into the combustion chamber, either due to a clogged fuel system, such as parts of the carburetor being gummy or dirty, damaged mounting gaskets, or a blown head gasket. Gasket deterioration would destroy the proper air-fuel ratio.

Air could enter the combustion chamber through one of the gaskets illustrated. When this happens a lesser volume of air will enter through the carburetor, picking up fuel as it moves through the air horn, the venturi and then into the combustion chamber.

Since the fuel pick-up into the air stream in the carburetor is largely dependent upon the volume or flow through the venturi, less air flow will result in less full pick-up and a leaner mixture.

The air flow can drop off to the point where there would be no fuel pick-up.

Gaskets.

Another place to check for the possibility of damaged gaskets would be on engines utilizing a cross-over tube, such as the Model 82000 and 92000 series. This photo shows the 82000 series with a gasket under a metal plate, shown by the circle. A similar type of gasket is used on the Model 92000 series, wherein the cross-over tube is bolted to the cylinder. Check these as well as the connection at the tube, where the "O" ring of the carburetor slips over, indicated by the upper red arrow, as well as checking the breather connections, illustrated by the lower red arrow.

Pulsa-Jet Carburetor.

The Pulsa-Jet carburetor incorporates a built-in pump. This pump is actuated by intake manifold pulsations. Fuel is pumped from the tank into a cup cast into or pressed into the top of the fuel tank.

A short fuel pipe extends from the carburetor into the fuel cup.

This slide illustrates the flow of fuel while the engine is operating. Fuel flows from the main tank, into the cup and then up into the carburetor.

Automatic Choke.

This slide illustrates the action of the automatic choke, showing how the choke is held in the CLOSED POSITION by a small spring while the engine is at rest, and once started vacuum leads into a chamber overcoming the spring tension and holding the choke in the OPEN position while the engine is running.

Leakage in the diaphragm, or such as loose mounting screws, etc., that could allow a loss of the vacuum chamber will allow the choke to remain closed or partially closed.

The automatic choke may be used on Vacu-Jet and/or Pulsa-Jet carburetors.

Faulty Carburetion Causes.

As you know, regardless of the type of carburetor used, most carbuetor difficulties are caused by one, or a combination of such factors as gasoline, gum, dirt, damaged needle valves, or leaking gaskets. These are the things we would be looking for if we did not have carburetion.

Two-Piece Flo-Jet.

The two-piece Flo-Jet carburetor could also be checked for sticking or leaking of inlet needle. Inspect the idle and high speed needle valves and seats. Look for clogged air passages blocking off the economizer passage, or the bowl vent. Check the float for leakage and level settings. On the large style carburetor, using a Viton tipped needle, be sure that the needle tip has not been deformed. As with all carburetors, check for dirt and gum. Most cases of inlet needle sticking are caused by dirt, gum, or a combination of both.

One-Piece Flo-Jet Carburetor.

One-piece Flo-Jet carburetors should be checked out for the same general conditions as the two-piece carburetor. It is not necessary to completely disassemble a carburetor prior to soaking it in cleaner, but do not remove the bowl, the float, and the needle valves. In other words, remove those parts which will help the cleaner to get at those areas to be cleaned so it can do a job more quickly and efficiently.

Remove any nylon parts before soaking a carburetor in cleaner for more than one-half hour, as some cleaners can damage these parts.

Diaphragm and Pipes.

If the engine is equipped with a Pulsa-Jet carburetor, the screen on the fuel pipe and the pump pipe could gum up, or be clogged from dirt. As you know, there is no check valve to cause trouble, but the diaphragm could be damaged, or the metering holes behind the needle valve could be obstructed.

Vacu-Jet Carburetor.

As you undoubtedly know, most of the problems with the Vacu-Jet carburetor would be gum on the check valve. Here again, a good cleaning may be all that is needed.

Incidently, if, for example, you have to replace or clean the fuel pipe because the check valve was stuck with gum, it is also highly recommended that you clean out the interior of the fuel tank, as stale gasoline and gum adhering to the wall of the fuel tank could cause fresh gasoline to become stale quite rapidly, and could result, of course, in a comeback.

Cleaning Carburetor.

Whenever it is necessary to clean a carburetor, you need not completely disassemble and remove and separate all parts, you should disassemble it enough so that the cleaning agent can get in and do the job.

In the lower lefthand corner you will note the two metering holes in the Pulsa-Jet and Vacu-Jet style carburetors. These must be cleaned; however, do not at any time run a wire into them, use cleaner and compressed air. These will be found by removing the needle, and then the seat. Before removing the seat, try to tighten it. A loose seat will vary the air-fuel ratio. If the engine did not run properly when brought in to you, this probably was the cause.

Our previous slides showed sectional views of the Flo-Jet carburetors indicating where gum could form or dirt gather.

As I mentioned before, remove any nylon parts before soaking the carburetor in cleaner.

Compression Loss.

Our initial check during the first five minutes indicated whether the engine did, or did not have good compression.

If compression was poor, most likely it is the result of poor valve seating. This could be worn valves, incorrect tappet clearance, or, in some cases, merely sticking valves due to stale gas and/or a gum situation between the valve stem and the guide.

A blown or loose head gasket could be another problem, or the possibility, of course, of an extremely worn engine with worn cylinder bore and rings.

Obviously, if our initial check showed poor compression, it would be necessary to go into the engine further to determine the cause of the compression loss.

Look For The Cause.

Obviously, not ALL engines will require ALL that we have gone into in checking over our Example. However, the point I wish to stress is a quick inspection for Ignition, Carburetion, and Compression, or lack of any of these three, plus, where applicable, check the Equipment to see of it is affecting the engine performance.

Once any one, or more, of these systems are found to be at fault, it would then be necessary to go further to pinpoint the exact cause.

After assembling all the facts you have observed while performing your diagnosis, you should, within a few minutes time, be able to tell quite accurately what parts and labor are necessary to repair the engine, or to determine if the engine is damaged to the point where it would not be economically feasible to repair it.

The main thing is that you would avoid duplication of effort and more quickly pinpoint just why the engine does not function the way it should.

You will also be able to determine what repairs are not only needed at that moment but also what repairs may be required in the near future.

Farm Business Management

Instructor's Guide:

1. This unit contains the following sub-units:
    a. Business Organization
    b. Leasing Arrangements
    c. Machinery Management
    d. Farm Business Management Principles
    e. Costs
    f. Combination of Enterprises Principles
    g. Records
    h. Budgeting
    i. Credit
    j. Income Tax Management
2. This unit may contain more information than you will need for your program. Select the appropriate sections for your use.
3. Included are worksheets and problem sets that correspond to the appropriate units. They are listed in the Table of Appendices.
4. It is recommended to use Farm Management, Principles, Budgets, Plans by J.H. Herbst as a text as listed under resources.

Objectives:

After completion of this unit, the student should be able to:

1. Understand the differences of each type of business organization.
2. List the major types and purposes of leases.
3. Figure depreciation using three different methods.
4. Determine which depreciation method to select.
5. Determine machine capacity.

6. List the three tools of management.
7. Explain the influence of supply and demand on prices.
8. Demonstrate the principles of diminishing returns, opportunity cost, and substitution.
9. Compare complimentary, supplementary, and competitive enterprise relationships.
10. Select enterprises according to comparative advantage principle.
11. Identify fixed and variable costs.
12. Understand the definitions of farm business management terms.
13. List types of records to be kept on a farm.
14. List value and uses of records.
15. Keep livestock and machinery inventories.
16. Able to keep financial records.
17. Prepare and interpret a financial statement.
18. Determine net farm income.
19. Prepare a net worth statement.
20. Construct a cash flow budget.
21. Calculate ratio of assets to liabilities.
22. Prepare a budget and understand importance of the budgeting process.
23. Identify and understand the different sources of capital.
24. List types of farm credit.
25. List steps and factors involved in getting a loan.
26. Identify different methods of interest calculation.
27. Identify those records needed for tax purposes.
28. Identify taxable income transactions and tax deductable expenditures.
29. Assist an accountant in preparing tax returns.
30. Complete a federal income tax return.

Teaching Aides:

1. The Agricultural Management Series: VEP
    - Farm Personnel Management - Sound filmstrip $32.50
    - Agricultural Cooperatives - Sound filmstrip $32.50
    - Farm and Ranch Management - Sound filmstrip $32.50
    - Agricultural Credit - Sound filmstrip $32.50
    - Agricultural Marketing - Sound filmstrip $32.50

Total Kit $146.25

VEP
Cal Poly State University
San Luis Obispo, CA 93407

2. Farm Business Management I and II
    - Teacher Edition FBM I $15.00
    - Student Edition FBM I $6.00
    - Binder FBM I and II $3.50
    - Teacher and Student Edition FBM II (write for price)

Oklahoma State Department of Vocational and Technical
Education Curriculum and Instructional Materials Center
1515 West Sixth Avenue
Stillwater, OK 74074

3. Farm Business Management Decisions Game
Developed by: Blue Mountain and Eastern Oregon Vo-Ag Instructors
The BMCC Farm Management Department.

Student Activities:

1. Farm Business Management Decisions Game.
2. Complete the various worksheets and problem sets as presented in this unit.

References:

1. Farm Management - Principles, Budgets, Plans: J.H. Herbst.
2. Arizona Ag Economics Instructional Unit, University of Arizona, Tucson, Arizona.

3. Farm Business Management, Becker and Castle, Macmillan, 1962.
4. Farm Business Management-Instructional Materials, Oklahoma Department of Vocational Education, Stillwater, Oklahoma.
5. Oklahoma Curriculum Guide IV, Oklahoma State University, Stillwater, Oklahoma.
6. The Farm Management Handbook, Luening and Mortinson, Interstate, 1972.
7. Introduction to Agribusiness Management (text and activity guide), McGraw-Hill Book Company.
8. Farm Estate and Business Planning: Neil E. Harl.
9. Farm Investment and Financial Analysis: Penson, Klinefelter and Lins.
10. Agricultural Law: Donald Levi, University of Missouri.
11. Pamphlets from the University of Illinois College of Agriculture.
    a. Planning a profitable farm business.
    b. Sources of farm credit.
    c. Law for the farmer.
    d. Setting up farm records to provide for analysis.
12. Doane's Farm Management Guide: Published by Doane Agricultural Service, Inc., 8900 Manchester Road, St. Louis, Missouri 63144.

Introduction Ideas:

1. Introduce unit with a sound filmstrip on Farm and Ranch Management from VEP materials.
2. Guest Speaker: a local farmer or an agribusiness representative.
3. Provide a practical, everyday problem to the students and in the process of finding a solution, they follow the same principles for solving FBM problems. (i.e., buying a car vs. buying a new tractor or piece of equipment.)

Table of Appendices:

1. Appendix A: FBM Terms Worksheet.
2. Appendix B: Business Organization Comparisons.
3. Appendix C: A comparison of the three methods of depreciation.
4. Appendix D: Demand, Supply, Diminishing Returns, Marginal Units: Worksheets, Charts and Problem Sets.
5. Appendix E: Opportunity Cost, Fixed and Variable Costs: Worksheets and Problem Sets.
6. Appendix F: Enterprise Combination: Worksheets and Problem Sets.
7. Appendix G: Budgeting: Worksheets, Charts and Problem Sets.
8. Appendix H. Credit: Worksheets and Problem Sets.
9. Appendix I: Taxes: Problem Set.

Farm Management Terms
(Refer to Appendix A)

AMORTIZED - a type of loan where interest and principle are repaid so there is an equal payment each month.

APPRECIATE - to increase in value. Best example is land or real estate.

ASSETS - all items of exchange value which a business or a person owns or controls.

BUDGET - an estimate of income and expenses before it happens.

CAPITAL - all nonhuman resources (except land) which contributes to production. (machinery)

COLLATERAL - items used to secure a loan. (security)

CREDIT - ability to obtain money, goods, services in exchange for a promise to repay.

DEPRECIATION - decline in value of asset due to age, obsolescence, wear and tear.

DEBT - an obligation to pay in the future. (amount owed)

ECONOMICS - the allocation of scarce resources to the best end.

ENTERPRISE - a business organization or a part of one that can be separated by accounting for economic and physical reasons.

EQUITY - the money value of property in excess of claims or liens against it. (owners capital)

GROSS INCOME - total of all income from a project before expenses are deducted.

INTEREST - the charge for the use of capital or money. (cost of renting money)

INPUT - any resource added to increase production or output. (fertilizer, feed, seed)

HORIZONTAL INTEGRATION - the coordination of decision making for two or more producing units operating on the same level of the production or marketing system.

VERTICAL INTEGRATION - the coordination of decision making for two or more producing units operating on successive stages of the production and or marketing system.

LABOR - physical human energy used in production.

LIABILITIES - the value or amount a business or person owes someone. (debt)

LIEN - a charge upon real or personal property until the payment of some debt.

LIQUIDITY - businesses ability to meet its current obligations in a timely fashion.

MANAGEMENT - the mental human energy used in production, generally decision making.

MARGINAL - refers to last or additional unit, either input or output.

MATURITY - date a loan is to be paid in full.

NET INCOME - net ownership of a business or the difference between assets and liabilities.

NOTE - written promise to pay a debt.

OUTPUT - yields or responses obtained from various quantities and combinations or inputs.

PRINCIPLE - amount of money borrowed or the true amount owed on a loan.

PROFIT - the excess of returns over expenditures.

SOLVENT - able and sufficient to pay all legal debts.

SHORTRUN - refers to a period of time needed for one or two production periods.

LONGRUN - refers to a period of time needed for a series of production periods.

MORTGAGE - a written claim, sometimes used to secure a loan.

I. Business Organization
(Refer to Appendix B)

A. Introduction.

Changes in farming have prompted a great deal of interest in the various forms of farm business organization and arrangements. Many progressive farm managers realize it may not be desirable or feasible to own all the resources they need to successfully operate their farm businesses. Some wish to merge into larger units with others who also have some farm resources. More multi-person or multi-family units are appearing. All because of the enormous sums of capital required to compete in modern farming. There are many alternative methods from which to select, including some combinations of these methods. There is no one answer as to which best form of farm business organization or arrangement to select. As in all legal matters, an attorney familiar with the farming business should guide and counsel the formation of a business organization.

B. Business Forms.

1. Individual ownership (single proprietorship).

2. Partnership (two or more owners).

    a. General

        1. Most common
        2. Partners full participants

    b. Limited (silent)

        1. Designed to attract capital but generally no management responsibility, only an investor.
        2. Names are not included in the partnership name.

3. Corporation.

    a. Definition - an artificial legal entity owned by shareholders that acts as an individual person.

    b. Types

        1. Closely held

            a. Small number of shareholders or a family
            b. Stock generally not available to others
            c. Most common type in farming

        2. Publicly owned

            a. Many owners (shareholders) possibly from many parts of the country.

4. Cooperatives.
    a. An enterprise organized by a group to serve themselves.

C. Advantages and Disadvantages of Different Business Forms.

1. Proprietorship.
    a. Advantages
        1. Owner in direct control
        2. Often low start-up costs
        3. Freedom from regulations
        4. Some tax advantages to small owners
        5. All profits to owner
        6. Minimal working capital required
    b. Disadvantages
        1. Unlimited liability
        2. Difficult to raise capital

2. Partnership.
    a. Advantages
        1. Ease of formation
        2. Low start-up costs
        3. Availability of additional capital
        4. Broader management base
        5. Possible tax advantages
        6. Limited outside regulations
    b. Disadvantages
        1. Unlimited liability, unless limited partnership
        2. Divide authority
        3. Hard to find suitable partners
        4. Difficult in raising large amounts of capital

3. Corporation.
    a. Advantages
        1. Limited liability
        2. Specialized management
        3. Ownership is transferable
        4. Continuous existance
        5. Legal entity
        6. Possible tax advantages
        7. Easier to raise capital

b. Disadvantages

  1. Closely regulated
  2. More expensive to organize
  3. Charter restrictions
  4. Double taxation
  5. Management more complicated

4. Cooperative.

a. Advantages

  1. Limited liability
  2. Specialized management
  3. Continuous existance
  4. Substantial tax advantages
  5. Add marketing strength
  6. Add purchasing power

D. Business Agreements.

1. Verbal.

  a. Many disadvantages

2. Written Agreements.

  a. Puts things on a business-like basis.
  b. Helps parties to think through potential problems before they happen.
  c. Helps prevent midunderstanding.
  d. Legal document and stands if person dies.
  e. Aids in settling matters at termination time.
  f. Protects parties involved and helps settle disputes.

II. Leasing Arrangements

A. Introduction.

Leasing is one method of obtaining control over productive agricultural resources without the capital outlay or debt associated with purchasing. With rapidly increasing capital inputs in farming more farm operators are turning to leases as an alternative method to owning. Leasing is one way a beginner can get started in farming with limited capital. Many farmers remain tenants all their lives and are very successful financially for ownership provides no assurance of success of any business.

A lease is a contract by which one party (owner, landlord or lessor) gives to another (tenant, renter or lessee) the use and possession of land and or buildings and machinery, etc., for a specified period of time for a specified payment.

The basis for a satisfactory farm lease is to provide a profitable and equitable system of farm operation to the parties involved. While initial negotiations for a lease usually begin with (1) the customary terms in the area, or (2) what would be "fair" to both parties, the primary objective usually is the maximum utilization of the resources available to be rented. The prices in the rent market are subject to supply and demand. When farmland in an area is scarce to rent or in small supply, and prospective renters are many, the renting price will be high. Naturally, the opposite situation also holds true to the above. Thus, there is a tendency for farm rental terms within a locality to be remarkably alike. Good land or good farms rent for about the same as poor ones. However, farms vary a great deal, and often customary rental practices or rates often fail to recognize fully the differences in the productive capabilities of the farm and the differences between landowners and tenants.

Many types and variations of leasing arrangements exist, but there are three common leasing arrangements. The following discussion deals with the advantages and disadvantages of these forms.

B. Cash Lease.

1. Definition: Under the cash lease the tenant pays an agreed cash rent for the use of the specified resources.

2. Advantages of cash lease.

    a. To the landowner

        1. Will receive a definite income.
        2. Close supervision of the farming operation not required.
        3. The lease is generally simple, therefore less chance of problems.

b. To the tenant

1. More freedom in operation of the farm.
2. Full benefit for his/her own managerial ability.
3. Lower rental rate.

3. Disadvantages of cash lease.

a. To the landowner

1. Tenants may tend to exploit the farm unless given assurance of more than a short period of occupancy.
2. Usually smaller income over time since he/she is not assuming as much risk.

b. To the tenant

1. It may be difficult to get the landowner to provide all needed improvements since income to him/her is fixed.
2. Rentals do not adjust to changes in prices or production unless some provision is made to review terms annually.
3. Requires more operating capital since all or part of rent may be paid in advance of harvest.
4. The tenant bears a heavier risk because he/she has guaranteed to pay a fixed rental rate.

C. Share Lease - Crop or Livestock.

1. Definition: Under the share lease the landowner and tenant should share the income in about the same proportion as the contribution each makes toward the business. It can be adapted to many different conditions but generally in crops its one-third - two-thirds share.

2. Advantages of Share Lease.

a. To the landowner

1. Generally a larger income because he/she is sharing in production and price risks.
2. More opportunity to supervise the operation of the farm.
3. May, under certain conditions, be eligible for Social Security coverages.

b. To the tenant

1. Risk is less than a cash lease, especially if low production or prices should occur.
2. Requires less capital than a cash rent.

3. Disadvantages of Share Lease.

   a. To the landowner

      1. Have to jointly decide on more adjustments than with a cash lease.
      2. Sometimes difficult to develop arrangements to give the landowner an appropriate return for his/her investments in improvements.

   b. To the tenant

      1. May find it difficult to get the landowner to furnish improvements needed for livestock or machinery storage.
      2. May wish to rent additional land and expand operations while the landowner may prefer more intensive farming on the present acreage.

D. Flexible Cash Rents.

   1. Definition: Considerable interest has also been indicated in making cash rents flexible. With fixed cash rents the landowner avoids the risks of low prices and poor crops. Because of this, he/she sometimes is willing to accept a lower rent than he/she would expect to realize on a share rent basis. On the other hand, fixed cash rent removes the possibility of sharing in high prices or good crops.

III. Machinery Management

A. Major Farming Costs.

1. Land.
2. Equipment.
3. Labor.

B. Machinery Management Importance.

1. Breakdowns very costly.
    a. Down-time
    b. Parts and service
2. Trading for newer machines.
3. "REMEMBER - Equipment should match the job!"

C. Machine Capacity Factors.

1. Determined by:
    a. Speed
    b. Width
    c. Efficiency (Field conditions, etc.)
2. Lost Time Factors.
    a. Unmatched machines
    b. Machine adjustment
    c. Unloading
    d. Unclogging
    e. Repairs
    f. Servicing
    g. Rest stops
    h. Filling
    i. Turning (17%)
    j. Using only partial capacity
    k. Field conditions
3. Formula.
    a. $C = \frac{WS}{10}$

C= Capacity in acres per hour
W= Working width
S= Speed in mph

* formula allows for 17% time loss in turning, filling, etc.

1. How many acres can be covered in an hour with a 12 foot disk traveling at 4 miles per hour?

$$C = \frac{12 \times 4}{10} = 4.8 \text{ A/hr.}$$

4. Other Formulas.

   a. Horsepower = $\frac{\overset{\text{(Draft)}}{\text{Force (lb)}} \times \text{Speed (mph)}}{375}$

      1. If a draft for a disk is 2,500 lb. and is pulled at 5 mph, what is the drawbar horsepower required?

$$\frac{2{,}500 \times 5}{375} = 33.3 \text{ Hp.}$$

   b. Speed = $\frac{\text{Drawbar Hp} \times 375}{\text{Draft (lb)}}$

      1. A tractor is pulling a plow with a draft of 5,000 lb. How fast can the plow be pulled if the tractor has 65 Hp.?

$$\text{Speed} = \frac{65 \times 375}{5{,}000} = 4.87 \text{ mph}$$

   c. Draft = $\frac{\text{Hp.} \times 375}{\text{Speed(mph)}}$

      1. If a field cultivator's draft is 280 lb./ft. of width, the tractor available is 85 hp. and the desired speed is 4.5 mph, what width could be pulled?

$$\text{Draft} = \frac{85 \times 375}{4.5} = 25.3 \text{ ft.}$$

5. Fuel Costs Per Acre.

   a. Formula - Fuel cost/A = $\frac{\text{Fuel used} \times \text{Fuel cost}}{\text{Acres covered}}$

6. Machine Drafts.

Draft lb/ft. of width

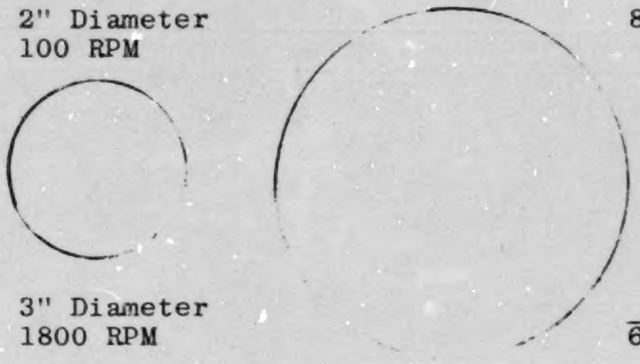
   a. Plow - 300-900
   b. Disk Harrow - 80-160
   c. Drill - 30-80
   d. Harrow - 20-60

7. Pulley or Gear Speeds and Diameters.

    a. Formula - RPM x Diameter = RPM x Diameter

        1. 2" Diameter
           100 RPM

        8" Diameter
        ___?___ RPM



        2. 3" Diameter
           1800 RPM

        ___?___ Diameter
        600 RPM

D. Factors to Consider in Machinery Purchases.

1. Type of machine.

2. Size or capacity.

    a. Length
    b. Width

3. Fixed costs.

4. Variable costs.

5. Capital requirements.

6. Labor saved.

7. Matching equipment to farm size and other equipment size.

E. Machinery Relationships to Size.

1. Machine size.

    a. Determining factors

        1. Farm size (also field size)
        2. Farming time due to climate
        3. Flexibility
        4. Major factor is cost of use/unit of output
           Example - $/A

F. Machine Wear Factors

1. Amount of use.

2. Machine adjustments or misadjustments.

3. Soil or field conditions.

4. Operator care and maintenance (proper lubrication and timely).

5. Fuel.

6. Load factor (over or underloading).

7. Climate.

G. Depreciation (refer to Appendix C).

1. Definition: The decline in value of an asset due to age, obsolescence, and or wear and tear.

   Involves the original cost of the item being spread over the useful life of the machine and is related to the replacement cost of another machine.

2. Purposes for Depreciating an Asset.

   a. Estimates annual non-cash expense
   b. Adjusts taxable income
   c. Estimates current value

3. Property Subject to Depreciation.

   a. Law permits a deduction of a reasonable allowance for the exhaustion, wear and tear of property used in a trade or business, or of property held for the production of income. Property used for personal use such as a personal automobile, is not deductible as a business expense. (A car depreciates just the same-partial arrival of Blue Book price.)

   b. Depreciable farm property includes all assets used in the business of farming and having a useful life of more than one year. Buildings on a farm or ranch are not depreciable if they are not used in the farming business, or if not used, were not purchased with the intention of using them in the farming business. The cost of land may not be amortized because land has no determinable useful life. Livestock acquired for work, breeding, or dairy purposes is depreciable, and then only if not inventoried. Animals raised or bought with the intent to resell, crops, feeds, seed, supplies, are all nondepreciable farm business items.

4. Methods of Computing Depreciation (most common).

   a. Straight-line (S.L.)
   b. Declining balance
   c. Sum of the years-digits
   d. Computation example for straight-line

1. Definition: This is the most commonly used method primarily because it is the easiest to calculate. With this method the same amount of depreciation is deducted each year of useful life of the item.

2. Procedure

   a. Must find the basis. When there is not a trade-in situation, basis is just the initial cost. When there is a trade-in, basis equals salvage value and any undepreciated balance of trade-in plus cash outlay for new assets.
   b. Estimate the years of useful life. There are no rules by which to make this estimate, however the I.R.S. furnishes guidelines. Basically, it depends upon the owners manner of using equipment.
   c. Determine the salvage value. This also depends upon how the owner uses the machine and the years of expected life assigned to it. (How much the item is worth when its replaced.)

3. Sample 1:

   A farmer buys a $20,000 tractor that he/she plans on using for 10 years. The value after 10 years (salvage value) is $5,000.

   **The salvage value is subtracted from the initial cost (basis) and the difference is divided by the useful life. The result is the annual depreciation.

   Step 1. $$\begin{array}{r} \$20{,}000 \\ -5{,}000 \\ \hline 15{,}000 \end{array}$$

   Step 2. $$\frac{\$15{,}000}{10 \text{ years}} = \$1{,}500 \text{ annual depreciation}$$

   Straight-line Formula: $$\frac{\text{Cost of machine-salvage value}}{\text{Number of years expected life}}$$

4. Sample 2:

   A truck was purchased for $5,500 and has an estimated useful life of 10 years. The salvage value is $500. Purchased on Jan. 8.

   $$\frac{\$5{,}500 - \$500}{10} = \$500 \text{ Annual depreciation}$$

Year	Annual Depreciation	Accumulated Depreciation	Depreciable Balance
1	500	500	5000
2	500	1000	4500
3	500	1500	4000
4	500	2000	3500
5	500	2500	3000
6	500	3000	2500
7	500	3500	2000
8	500	4000	1500
9	500	4500	1000
10	500	5000	500

The above table exhibits the complete depreciation schedule for the truck.

However, if the truck were purchased at mid-year, the first years depreciation would be half of the annual rate or $250. Each year thereafter the depreciation would be $500 until the last part of the final year when it would be $250.

5. Sample 3:

A farmer is trading in an old combine for a new one. The undepreciated balance including salvage value on the old combine is $10,000. Salvage value of old machine is $5,000, thus the depreciable balance is $5,000. In addition to the trade-in, $40,000 is required to buy the new combine.

Basis = $40,000 + $5,000 + $5,000 = $50,000

$$\frac{\text{Basis - salvage value}}{\text{Years of life}} = \text{annual depreciation}$$

$$\frac{\$50,000 - \$5,000}{10} = \$4,500 \text{ annual depreciation for new combine}$$

e. Computation example for declining balance

1. Definition: This method is a fast write-off method which yields greater depreciation the first year and decreases over time. Salvage value is not used in the computation, but the asset cannot be depreciated below a reasonable salvage value.

2. Procedure:

   a. Know the basis
   b. Establish the rate of depreciation - usually 20%
   c. Estimate salvage value. An item can never be depreciated below it

3. Sample 1:

A farmer purchases a $50,000 combine.

*Declining Balance Formula -

$$\frac{\text{Constant percentage}}{100} \times \text{Remaining value} = \text{Annual depreciation}$$

(Basis) $50,000 x 20% = Annual depreciation - remaining value

1st year	50,000 x 20% = $10,000	depreciation
2nd year	40,000 x 20% = $ 8,000	
3rd year	32,000 x 20% = $ 6,400	
4th year	25,600 x 20% = $ 5,120	
5th year	20,480 x 20% = $ 4,100	
6th year	16,380 x 20% = $ 3,280	
7th year	13,100 x 20% = $ 2,620	
8th year	10,480 x 20% = $ 2,100	
9th year	8,380 x 20% = $ 1,680	
10th year	6,700 x 20% = $ 1,340	

f. Computation example of sum of the years digits

1. Definition: This method completely depreciates the basis of an asset over the period of its useful life. It allows greater depreciation charges in earlier years, but not as great as the declining balance method.

2. Procedure

   a. Know the basis
   b. Establish salvage value
   c. Calculate the sum of the digits

      1. Add together the estimated number of years of life in this manner. Ten years expected life: 1+2+3+4+5+6+7+8+9+10= 55 sum of digits.

3. Sum of digits formula

   a. $$\frac{\text{Remaining life in years at beginning of year}}{\text{Sum of each of the number of years expected life}} \times \text{Original Cost} = \text{Annual Dep.}$$

   b. Cost - salvage value x sum of digits

4. Sample 1: A farmer buys a $50,000 combine. Salvage value is $5,000.

   1st year - \$50,000-\$5,000 x $\frac{10}{55}$ = \$8,180.

   2nd year - \$45,000 x $\frac{9}{55}$ = \$7,360.

   3rd year - \$45,000 x $\frac{8}{55}$ = \$6,540.

   4th year - \$45,000 x $\frac{7}{55}$ = \$5,730.

   5th year - \$45,000 x $\frac{6}{55}$ = \$4,905.

   6th year - \$45,000 x $\frac{5}{55}$ = \$4,090.

5. Allowances made in computing depreciation

   a. Additional first-year depreciation - one may elect to write off 20 percent of the cost of an asset for the first taxable year for which a depreciation is allowable in addition to the regular depreciation of the balance. This additional depreciation is computed on the cost of the asset without a deduction for salvage value. The additional 20 percent allowance applies to tangible personal property to the extent of $10,000 of cost, with a remaining useful life of at least six years.

      Example - If a farmer buys a $30,000 machine, 20% of the first $10,000 may be taken.

   b. Salvage value - I.R.S. regulations state that as asset may not be depreciated below a reasonable salvage value under any method of depreciation.
   c. Proration of Depreciation Allowance - If a depreciable asset is acquired during the year, only part of the full year's depreciation is allowed. To compute the partial deduction multiply the first full year's depreciation by the months the property was owned and divide by 12. For example, if it was owned for six months during the year, the deduction would be 6/12 or half of a full year's depreciation.

6. Determining which method to use

   a. Use method which best approximates the loss of value
   b. Ease of computation

c. Examples

1. Power machinery (trucks, tractors, combines) normally change in value faster in the early years than in the later years of life, so the declining balance method usually works best for these items.
2. Nonpowered machinery (plows, planters, wagons) normally change in value about equally throughout their life, so straight line method is generally used for these types of items.
3. Farm buildings do not have an established market value. Usually straight line is used.
4. Experimental or new untried machines don't have an established length of service so would want to depreciate faster than normal.
5. Small tools and equipment whose purchase price is relatively small and whose service life is undetermined should be included in the inventory but probably not depreciated. Normally these items are written off as an expense in the year purchased.

d. Income tax considerations

1. From a tax management standpoint, a farmer should utilize the method that gives the greatest potential advantages. During periods of high income the farmer would want to use the faster write-off methods to reduce tax liability.

7. General comparisons of depreciation

a. Each of the three most common methods of depreciation yields a different amount each year in the useful life of the asset. In the first year, the declining balance gives the greatest depreciation, followed by sum of the digits and then straight line. However, the reverse is true in the last year. Most farmers use the straight line method because of its simplicity.

IV. Farm Business Management
(Refer to Appendix D)

A. Introduction:

The role of management is becoming increasingly important in modern farming. Farm Managers must use organized decision making and must understand the nature of the management job to arrive at appropriate business decisions. Farm managers operate farms to make money or to attain other specified goals. They must effectively manage their land, labor and capital to succeed.

There is a difference between a successful farm and a successful farmer. Successful farming, if its measured by profitability is determined by farmers managerial ability. A farmer may be financially successful by taking over the home farm, or acquiring one through marriage with no debts, or by inheriting one from a rich uncle. Often such farmers follow methods and practices which would not meet interest and principle payments on a morgage if these had to be paid along with family living expenses.

B. Example:

Mr. Brown

*Start-Receives farm debt free (marriage)
Superior mechanic
Good husband, dry man
Serious, hard working

Mr. Smith

*Start-Tenant farmer, little capital
Adapted new methods that cut costs
Made timely decisions

!!!Eventually, Mr. Smith owned his farm and is buying Mr. Brown's with Brown working for him.

*Farm Management is making decisions that affect the profitability of the farm business!!

*Successful management is not the ability to make decisions alone but, the right decisions! Good farm managers must become skilled decision makers not simple labor task doers.
"The average person has five senses: sight, taste, smell, touch and hearing. The Successful Farm Manager has one more: Common!!!"

C. Common Farming Decisions:

1. What farming enterprise (type) should be engaged in?
2. How large of a farm, how much to produce?
3. How many acres owned, amount of capital, and amount of labor?
4. How should the factors of production, land, labor, capital, management work together? How should certain functions be performed?
5. What practices to use, how much seed fertilizer, etc?

D. Steps in the Decision Making Process:

1. Establish goals and values.
2. Gather information, ideas, and make observations.
3. Analyze observations-evaluate and compare outcomes.
4. Decision making-select the best alternative.
5. Implement the decision.
6. Accept responsibility for actions.
7. Evaluate the decision or results.

E. Basic Tools of Management:

1. Economic Principles.
    a. The first tool we will examine is Economic Principles. These principles and concepts aid farm managers in arriving at the best decisions for a given set of circumstances. They also develop logical thinking and common sense.
    b. "Perfect Knowledge" is a philosophy one must assume when learning about these main principles, in other words there are no variables (uncertainty) to change or alter data or outcomes. This of course is not the "real world". Risk and uncertainty face farm managers constantly thus things are constantly changing.
    c. These principles and concepts once mastered will make your job as a farm manager easier and will also help you arrive at better, more profitable decisions.
    d. These principles and concepts also apply to businesses other than farming, so no matter your final career they will be very useful.

2. Records - often the key.

3. Budgets.

F. Understanding Opportunity Costs:

1. Definition:

    a. Opportunity Costs describes the value of the product that was not produced because scarce resources were used for a different purpose.

    b. A good manager will use his/her scarce inputs where marginal return is greatest.

2. The Principle - Profits will be greatest if each unit of labor, capital, and land is used where it will bring the greatest added (marginal) return.

3. Example:

    a. Leading Questions?

        1. Have you ever had to make a choice between two things you wanted?
        2. Why didn't you get both?

    b. Problem: A Vo-Ag student wants to buy a car and also wants to develop his/her farming program. Like most students he/she has limited capital and cannot have both and if he/she buys one of them, the other choice is not available to him/her. Thus, he/she has an opportunity to buy either the car or invest the money in his/her farminig program but not both due to limited resources.

    c. Conclusion Qeustions:

        1. Does a car make you money?
        2. What would be the advantage in buying a car?
        3. Does an investment, your farming program, return you any money?
        4. What would be the advantages in investing in a farming program?
        5. How could the investment be used to increase income?
        6. Could the car be used in obtaining money to expand the farming program? How?

    d. Conclusion:

        1. The Ag student must choose the best use for his/her money. Likewise a farm manager must decide where each unit of land, labor, capital resources should be used to maximize profits.
        2. Expansion of one enterprise decreases the opportunity to expand another if resources are limited.

3. A cost is incurred in not developing one enterprise (anticipated income) in favor of another.

G. Understanding Substitution Principles:

1. Definition:

a. The principle of substitution states that if the quantity of output is constant, it is economical to substitute one factor of production for another factor of production if the cost of the first is less than the cost of the second.

b. This principle provides the logic for determining the least-cost method of production. Often in the production of ag commodities it is possible to substitute one factor of production for another. Many inputs can be substituted for each other, an example, machinery can be substituted for labor, silage for hay, soybean meal for cottonseed meal, corn for barley, etc. In a similar fashion, it may be possible to substitute capital in the form of labor-saving equipment for labor in the production of some commodities.

c. A good manager is always alert to the possibility of substituting one input for another to maximize profit.

H. Understanding Comparative Advantage:

1. Definition:

a. Comparative Advantage compares the profitability of a particular enterprise produced in one area as compared with other areas. In any given area most farmers follow nearly the same pattern and practices of crop and or livestock production. This results in a particular type of farming within a region which becomes quite fixed. This means that a farming type area has been established after many years of effort put forth by individual farmers to adjust their capital, labor, land and managerial ability to get the greatest net return. Those products which have been most profitable over the years are being produced in larger amounts while the less profitable ones have gradually faded out.

2. Illustrations:

a. Some decades ago many sheep were kept on New York farms. But gradually the demand for fluid milk in the big city markets made dairying more profitable than raising sheep, so dairying gradually came in. Most sheep production today exists in range areas where they can be raised to better advantage than any other type of livestock.

   b. Another is that Wisconsin was once a great wheat state, but dairying has pushed it out.

3. Influencing Factors:

   a. Markets
   b. Changing customs
   c. Freight rates
   d. Labor supply
   e. Environmental
   f. Diseases
   g. Insects
   h. Climate
   i. Soils
   j. Topography
   k. E.P.A.

4. Just because an enterprise is profitable doesn't mean it should be produced!

V. Costs
(Refer to Appendix E)

A. Types.

1. Fixed.

2. Variable.

3. Total.

B. Fixed Costs.

1. Definition: Costs that don't change with output or do not vary with level of production. They will occur whether something is produced or not.

2. Considerations.

a. Don't change in total, but in per unit.

1. Example - Higher yields spread a nonchanging cost over more units.

b. One has little or no control over.
c. They are not relevant to future decisions.
d. Generally, the shorter the time, the greater the fixed costs.
e. Examples:

1. DIRTI 5 - Depreciation, Interest, Repairs, Taxes, Insurance.
2. Mortgage payment, rent.

C. Variable Costs.

1. Definition: Costs that change with the level of production and only occur when production takes place. (Operating costs.)

2. Considerations.

a. "Decision making" costs - one can exercise complete control.
b. Change with changes in output - don't change per unit, change in total.
c. If a practice will pay the variable costs, it will be undertaken; if it can't pay variable costs, it should not be undertaken.
d. Some variable costs become fixed, once they are put into the business (pesticides once applied to a crop become fixed costs to that crop).

   e. Fixed costs can become variable over the long-run with careful management
   f. Examples:

      1. Fuel
      2. Tires
      3. Seed
      4. Fertilizer
      5. Feed
      6. Membership
      7. Herbicide

3. Money management is the key to the people that will be farming in the future.

D. Understanding Principle Information.

1. Example:

   a. Costs of operating a car.

2. Considerations.

   a. How many of you own a car?
   b. How many of you drive the family car?
   c. If you drive your car, what costs do you have to pay? (List on the board.)
   d. If you drive the family car, what costs do you pay? (List on the board.)
   e. Are all the costs in operating a car alike?
   f. What will be the cost of oil if you do not drive the car next year?
   g. What will be the interest cost at 12 percent on $2,000 if you do not drive the car next year? Car payments?
   h. Separate costs into fixed and variable.

VI. Combination of Enterprises Principles
(Refer to Appendix F)

A. Definition:

1. The proper combination of enterprises on a farm influenced by the relationship that exists between and among enterprises. A different relationship exists between barley and alfalfa than exists between barley and oats. A farm forestry woodlot that utilizes winter labor will have a different relationship to strawberries than will a dairy enterprise.

2. Some farm enterprises fit into the resources framework of a farm or ag area better than others. Selecting the appropriate enterprise combination takes a lot of thought and planning, but these enterprise combinations should fit the available resources of land, labor, capital and management.

B. Example:

1. You were recently hired to manage a 300 acre farm with 220 acres tillable, 60 acres permanent pasture, farm buildings, a complete line of equipment to operate this farm, enough livestock to stock it correctly and a reasonable capital to work with.

2. Considerations.

   a. How would you combine the different enterprises on this farm to max. returns?
   b. What crop enterprises would give the highest returns on the cultivatable land and make the best use of the soil, your time and your machinery?
   c. What livestock enterprises would fit in best with your crops and buildings?
   d. In what way would you combine all the enterprises on this farm to make the best use of all the resources available?

3. These questions must be faced and answered by every successful farm business manager!!

C. Factors in Consideration in Combining Enterprises:

1. Select enterprises which will distribute labor throughout the year and make optimum use of land.

2. Select enterprises which will use similar equipment, buildings or machinery as much as possible, without direct conflict.

3. Try to plan operation around existing facilities as much as possible.

D. Enterprise Combinations:

1. Complementary:
    a. The output of one enterprise increases the other one's output will also increase.
    b. Examples:
        1. Grass seed - sheep
        2. Clover - grass pasture
        3. Nurse crop
        4. Wheat - market livestock

2. Competitive:
    a. As the output of one enterprise increases the resulting output of the other enterprise decreases.
    b. Two enterprises competing for the same resources at the same time. (Two crops need harvesting with the same machine the same time.)
    c. Most enterprises can be competitive at some time or another.
    d. Examples:
        1. Barley vs wheat
        2. Turkeys vs broilers
        3. Walnuts vs filberts

3. Supplementary:
    a. A combination where output of one enterprise doesn't effect another enterprise's output but adds to the overall program.
    b. Makes use of resources that otherwise might not be used.
    c. Continual increased size of a supplementary enterprise can become competitive.
    d. Examples:
        1. Family milk cow
        2. Family chicken flock

4. Farmers generally adjust to get best combinations.

E. Production Methods.

1. Specialization.
    a. The production of one major product.

- b. Advantages:
  - 1. Volume production
  - 2. Intensive
  - 3. Offers unique marketing possibilities that might result in higher prices.
- c. Disadvantages:
  - 1. All "eggs" in one basket (greater risk).

2. Diversification.

- a. The production of several products.
- b. Advantages:
  - 1. Tends to better utilize all resources of units.
  - 2. Tends to reduce risk.
- c. Disadvantages:
  - 1. Spread too thin, resulting in doing nothing well.

Special Examples - Vertical Diversification
A producer-distributor of milk would raise crops, replacement heifers, milk cows, pasturize, bottle and deliver milk.

F. Farm Management.

1. Intensive.
   - a. Large amounts of output from relatively small resource (most nursery-greenhouse operations).
2. Extensive.
   - a. Usually large quantity of fixed inputs are needed (rangeland cattle or sheep operation).
3. The above decisions must be based on managers interests, experience, qualifications, desires and goals.

VII. Management Tool: Records

A. Primary Reasons for Keeping Records.

1. Income tax - to manage lowest possible taxation.
2. Effective estate planning and settlement.
3. Division of products for lease settlement.
4. Provides facts for management decisions - diagnostic tool.
    a. Useful in budgeting.
    b. Useful in enterprise selection.
    c. Useful in enterprise management.
    -- Identifies strengths & weaknesses
5. Obtain and manage credit easier.
6. Provides a measure of farm growth.
7. A business in the long-run is only as good as its records.
8. Records tell one where you've been, where not to go and sometimes how to get there.

B. Kinds of Records.

1. Production.
2. Financial (basic).
    a. Income and expenses (Earnings Statement)
    b. Net Worth
    c. Cash Flow Statement
3. Inventory - Depreciable and Nondepreciable.
4. Enterprise.
    a. Production
    b. Service
    c. Holding (storage)
5. Other physical records.
    a. Examples: labor, fuel consumption
6. Governmental required records.
    a. Tax returns from seven years past and proof of claimed deductions.

C. Essentials of Good Records.

1. Easy to keep.
2. Complete - give essential information.
3. Give timely information.
4. Accurate.
5. Must be used to be any value.

D. Complete Records Should Include:

1. Inventory of quantity and value of all property at beginning and end of year.
2. All livestock and livestock products raised.
3. Acreage and production of all crops.
4. A record of all transactions during the year including quantity, prices, and parties involved.

E. Completed Records Analysis.

1. Measures of Success:
    - a. Net farm income.
    - b. Labor income.
    - c. Percent return of investment.
    - d. Net capital ratio.
    - e. Working capital ratio.
2. Efficiency.
    - a. Livestock returns per $100 invested.
    - b. Livestock return per animal unit.
    - c. Machinery cost per crop acre.
    - d. Machinery investment per acre.
    - e. Crop income per acre.
3. Size.
    - a. Average farm capital.
    - b. Gross income.
    - c. Total acres in crops.
    - d. Total animal units of livestock
    - e. Total annual inputs.

F. Methods of Accounting.

1. Cash method.

   a. Expenses are expenses when actually paid and income is income when it is actually received. (Entries are made only after money has exchanged hands.)

   b. Advantages:

      1. Simple - most farmers use this method.
      2. Can time income and deductions.

   c. Disadvantages:

      1. Can be misleading for management purposes.
      2. Expenses are not deductable until paid.

2. Accrual method.

   a. Expenses are expenses when incurred, regardless of when cash is paid. (Income is income when it's earned.)

   b. Advantages:

      1. Income can be matched against expenses.
      2. Expenses may be deducted although payments not paid until the following year.
      3. Often more evenly spreads income.

   c. Disadvantages:

      1. Difficult to use.
      2. Can be misleading because fails to postpone tax payment.

3. Net Farm Income = Total Receipts - Total Expenses + mortgage interest + unpaid family labor + or - Inventory change.

4. Capital Ratio = $\frac{\text{Assets}}{\text{Liabilities}}$ $\frac{98,312}{19,615} = 5:1$

   (anything below 2:1 is risky)

VIII. Management Tool: Budgeting

A. Principles.

1. Definition:

   a. A budget is merely a device for testing the anticipated desirability of enterprise combinations in terms of profitability.
   b. It is the planning phase of farming. Budgets deal with future action. (A tool to look into the future.)
   c. Don't confuse with records - they look back.

2. Used as a tool for applying the principle of opportunity cost in using limited resources most profitably.

B. Budgeting Advantages.

1. Chief advantage - provides valuable information for making sound decisions.

2. Uncovers hidden or overlooked costs.

3. Helps when borrowing money.

4. Allows for experimentation - much cheaper to make mistakes on paper than in actual practice. (A money saver.)

5. Useful when refining present organization.

6. Identifies items that have several years of useful life.

C. Budgeting Disadvantages.

1. Requires your organized thought about your own farm.

2. Accurate budgeting preparation is time consuming.

3. May not have all the data needed.

4. Only as good as the information and judgement that goes into it.

5. Comparisons cannot be drawn from budgets of one farm to another.

D. Types of Budgets.

1. Complete Budget.

   - a. Used to organize entire business.
   - b. Often used after purchase of a business.
   - c. Used for long-run planning.

2. Partial Budget.
   - a. Used for testing profitability of only a portion of the business.
   - b. Used in adding or changing an enterprise.
   - c. Used to determine if new purchases should be made.
   - d. Used for short-run planning.

3. Enterprise Budget.
   - a. Estimates potential income from particular situations.
   - b. Estimates cost of production for one unit of an enterprise.

4. Cash Flow Budget.
   - a. Estimates dated income flows and expense flows through the year to determine actual cash flow within the business.

E. Steps in Developing a Budget.

1. Appraisal of the goals and objectives.

2. Inventory - what do we have to work with?
   - a. Land and its limitations.
   - b. Capital - amount and types available as well as credit capacity.
   - c. Labor available.
   - d. Capabilities and limitations of the farm manager.

3. Past production performances and returns.

4. Compare your operation with others locally.

5. Arriving at price estimates.
   - a. Actual prices for previous year.
   - b. Projected price based on trends, production cycles, competition, or technology.

IX. Credit

A. Definition:

1. Credit - individuals or businesses borrowing capacity; his/her debt potential.

B. Purpose:

1. Credit is a tool in the farm business which must be properly and effectively used just like a tractor. Today, just like the tractors getting bigger, farmers must deal with large volumes of borrowed money. Much of that debt load is land but machinery is more expensive every year and the management of these large debt loads means the success or failure of the farm business.

2. Credit can:

   a. Help establish and maintain a farm business of adequate size.
   b. Assist in making needed changes in the farm business to meet changing conditions.
   c. Improve the efficiency of the farm business.
   d. Keep the business moving through times of income fluctuation.
   e. Provide for the transfer of a profitable farm business to another operator.

C. Wise Credit Use Principles.

1. The 3 R's:

   a. Returns
   b. Repayment capacity (Map out Credit Needs)
   c. Risk

2. Use credit for productive purposes.

3. Limit borrowing on unfamiliar or new enterprises.

4. Credit should be used where it will generate the greatest income.

5. Know where you stand - keep records and evaluate performance.

6. Keep debts in line with income repayment capacity (cash flow).

7. Study markets and trends.

8. Have definite repayment program.

9. Carry adequate insurance.
10. Shop for a loan (what does loan actually cost).
11. Be businesslike (fair-frank).

D. Types of Credit.

1. Current - generally one year, sometimes two (production loan).
2. Intermediate - two to seven years (machinery).
3. Long-term - more than seven years (predominately land purchases).

E. Credit Sources.

1. Individuals.
2. Dealers and merchants.
3. Ag Stabilization and Conservation Service (ASCS).
4. Commercial Banks.
5. Insurance companies.
6. Production Credit Association.
7. Federal Land Bank.
8. Farmers Home Administration.

F. What Lenders Look For:

1. The 3 C's for Credit:
   a. Character
   b. Capacity
   c. Collateral

G. Factors to Select Credit Agency.

1. Ag knowledge and understanding.
2. Reputation.
3. Availability of credit.
4. Lending policies.
   a. Interest rate (method).
   b. Repayment schedule (liberal).
   c. Closing costs or service fees.
   d. Minimum deposits.
   e. Handling of emergencies.

5. Interest rate alone is not a good comparison of agencies.

H. Interest Comparisons. (Remember, interest is the cost of renting money.)

1. Methods.

   a. Flat rate - \$1,000 for one year at 10 percent = \$100 interest.
   b. Discount or Front End Loan - \$1,000 loan at 10 percent interest - Receive only \$900 and pay back \$1,000.
   c. Add-on interest - \$1,000 loan + interest divided by number of payments.

$$\frac{\$1{,}000 + \$100}{12} = \$91.67 \text{ payments}$$

   d. Interest on Unpaid Balance -
      \$1,000 for one year at 12 percent
      After six months paid \$500

$$\begin{array}{rl} \$1{,}000 \text{ @ } 12\% = \$120; & \$120/2 = \$60 \\ \$500 \text{ @ } 12\% = \$60; & \$60/2 = \underline{\$30} \\ & \$90 \text{ interest} \end{array}$$

*Save \$30 or equivalent to 9 percent money

   e. Amortized (loans where interest and principle are repaid so there is an equal payment each month or each payment). At first a large part of the payment is interest only. As the loan matures more principle is paid off.
   f. Interest only - No principle payments or deductions for the early years of the loan (1-5 years). Later interest and principle payments are made over the remaining life of the loan.

I. Interest Cost Comparisons.

A. \$20,000 for 20 years.

Interest rate
5% - \$12,080 in interest
6% - \$14,880 in interest
10% - \$24,322 in interest
15% - \$41,206 in interest

B. Time at 10 percent interest.

Years
15 - \$17,780 in interest
20 - \$24,322 in interest
25 - \$31,000 in interest
30 - \$38,120 in interest

X. Income Tax Management
(Refer to Appendix I)

A. Definitions.

1. Income tax.

   a. Personal tax on an individual's net income.

2. Tax Management.

   a. A year-round process in which a person is constantly making decisions that influence their income tax. (Not a once a year concern.)
   b. Like farm costs - taxes can be reduced by "good management."
   c. Important because taxes reduce the amount of money available for family living or investment. Taxes can't be reduced after transactions.
   d. Tax management doesn't conflict, necessarily with maximum profit.
   e. Objective: Pay the smallest amount of tax over a period of years. Doesn't mean lower income just to avoid taxes because this could mean that little or no ownership of property or assets is happening. (Very foolish to take a loss in income because of poor timing or handling of a sale just to save taxes.)

3. Factors Required to Reduce Taxes.

   a. Taking appropriate business deductions.

      1. For every $5 expenses not deducted results in at least $1 tax.
      2. Examples: hired labor, repairs, insurance, trade magazines, advertising, organization dues, business telephone calls, tax preparation, etc.

   b. Keeping accurate records.

      1. Enables manager to check income and expenses at any time to make tax intelligent decisions that increase net income after taxes.
      2. Basis for Social Security payments.

   c. Avoiding income fluctuation.

      1. Generally, increased income stability tends to reduce income taxes.
      2. Income tax is progressive in nature; it increases proportionately to income.

d. Managing personal deductions.

1. Examples: interest on personal items, medical expenses, contributions.

e. Substituting capital gains for ordinary income.

1. The manner in which a farm is bought or sold affects taxes.
2. Tax considerations should be considered when buying a farm.

f. Tax consultants.

1. Tax laws constantly change, thus a good tax consultant easily pays for their services.

4. Income Tax Credits.

a. Investment credit.

1. Directly reduces tax liability.
2. To qualify, property must be depreciable property and have a useful life of at least three years.
3. Rates: 3-5 years life - 1/3 or 3.3 percent;
5-7 years 2/3's allowable credit - 6.6 perce
Useful life over 7 years the full credit is available, 10 percent.
Example; $80,000 combine is eligible for $8,000 credit.

APPENDIX A

FBM Terms Worksheet

1. A ____________________ is used to estimate future expenses and income.

2. The declining value of an item due to wear or use is called ____________________.

3. Many loans are ____________________ to make the payments equal over a period of time.

4. The charge for borrowing money is ____________________.

5. ____________________ is the allocation of scarce resources.

6. Buildings, equipment, livestock and machinery is part of a farmer's ____________________.

7. ____________________are the financial returns after expenses have been deducted.

8. A charge upon real estate until a debt is paid: ____________________.

9. ____________________ is the ability to charge or get loans.

10. The debts of a person or business are ____________________.

11. ____________________ is the difference between assets and liabilities.

12. When something is increasing in value: ____________________.

13. ____________________ is the actual amount of money borrowed.

14. Yields in general can be called ____________________.

15. ____________________ is a written promissory debt.

16. The last added unit is referred to as the ____________________unit.

17. ____________________ is used to secure loans.

18. Decision making is ____________________.

19. When a loan ____________________ it must be paid.

20. All items of value that one owns is called ____________________.

21. ____________________ is the ability to pay all debts.

22. Total of all income is called ____________ ____________________.

23. ______________________ is an obligation to pay in the future.

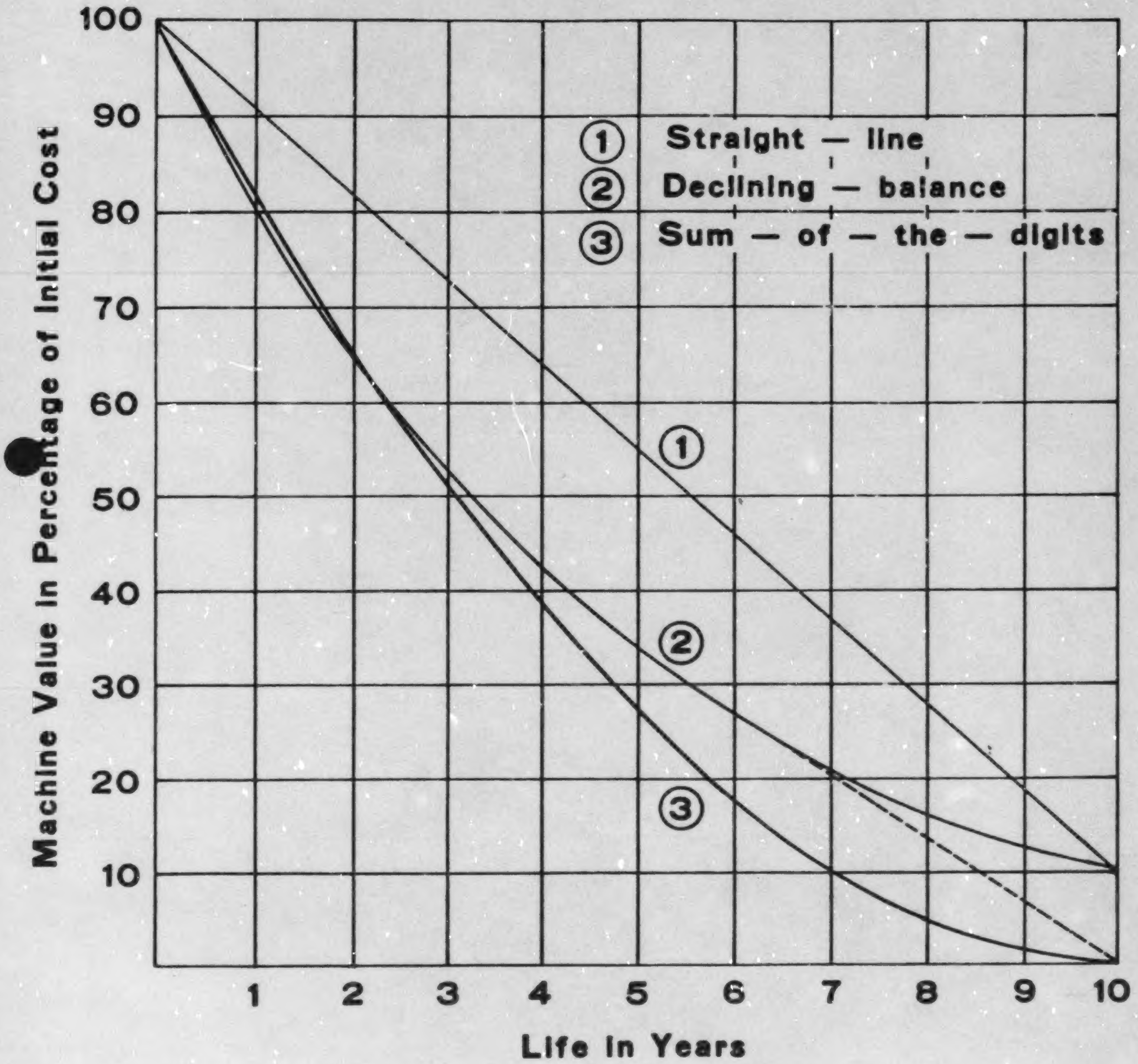
24. Refers to a period of time over many production periods: ___________________________.

25. Beef, wheat, hogs, hay are examples of a farm's separate ____________________________.

APPENDIX B
Business Organization Comparisons

	Sole Proprietor	Partnership	Corporation
Nature of entity	Single individual	Aggregate of two or more individuals	Legal person separate from shareholders
Who Owns the Business	The individual	The partners	The stockholders
Life of Business	Terminates on death	Agreed term or on partner death	Perpetual or fixed years
Management decisions	The individual	Agreement of partners	Shareholders elect directors who manage business through officers elected by the directors
Liability	Personally liable (all property)	Each partner liable for all partnership obligations	Shareholders not liable for corporate obligations
How is Business Financed	Personal capital; loans	Partners' capital and loans	Sale of stock, bonds, and other loans.
How May Profit be Used	Owners desires	As agreed by partners	Dividends, reserves and surplus
Transfer of Interest	Terminates proprietorship	Dissolves partnership; new partnership may be formed if all agree	Transfer of stock does not affect continuity of business
Effect of Death	Liquidation	Liquidation or sale to surviving partners	No effect of corporation. Stock passes by will or inheritance
Income Tax	Income taxed to owner	Partnership files an information return but pays no tax. Each partner reports share as an individual.	Corporation files a tax and pays tax on income; salaries & shareholders dividends deducted. Shareholders taxed on dividends.

A COMPARISON OF THE THREE METHODS OF DEPRECIATION



APPENDIX D

Understanding Demand Exercise

PROBLEM I

A grain warehouse manager is attempting to establish a price on 1,000 million bushels of wheat in storage in order to sell the entire crop inventory within the next month prior to the new crop harvest. The following data indicates the price-demand relationship of wheat.

Price of Wheat/Bushel	Quantity Bought/Month (Millions of Bu)
$4.80	890
4.60	950
4.40	1020
4.20	1100
4.00	1190
3.80	1290
3.60	1405
3.40	1525

*Complete the demand curve graph with the above data.

WHEAT DEMAND CURVE

Price Per Bushel

4.80
4.60
4.40
4.20
4.00
3.80
3.60
3.40

0 200 400 600 800 1000 1200 1400 1600

Millions of Bushels of Wheat Purchased/Month

QUESTIONS??

1. In which direction does the demand curve slope? (All will slope same direction but will vary in angle of slope.)

2. How many bushels of wheat are bought if the price is $4.80/bu?

3. At $3.40/bu., how many bushels of wheat would be purchased?

4. What price should the warehouse person charge in order to sell the entire amount of wheat?

5. If the warehouse person wanted to sell more than the original amount, what would he/she probably have to do in order to sell more?

6. A foreign grain broker wants to buy the wheat, but if he/she cannot pay the price, will his/her demand affect the price-demand curve?

7. As the price rises, the amount of a commodity purchased ____________.

8. As the price of an item decreases, does the demand increase?

9. What happened to the quantity bought as price decreased?

10. Would this wheat demand curve hold true every year?

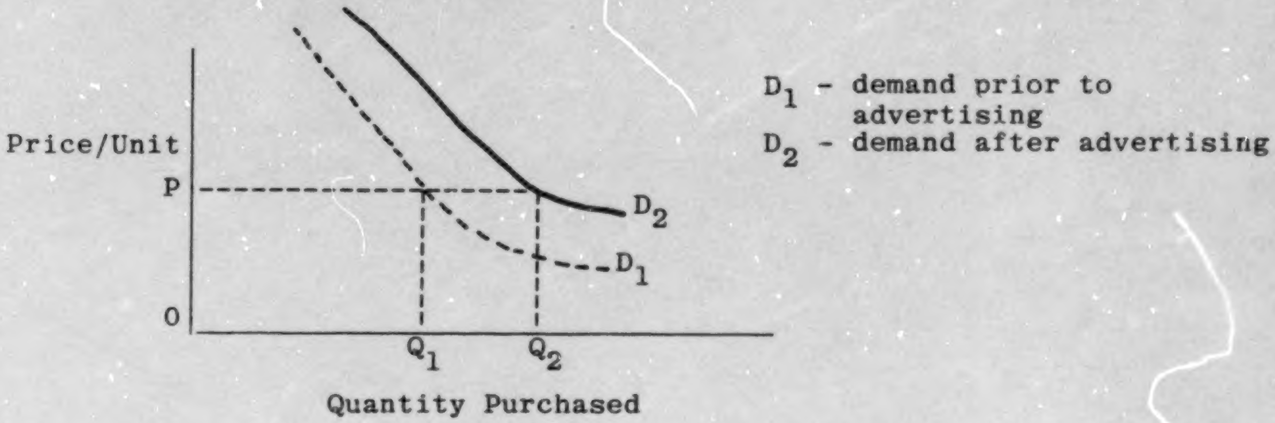
Changing the Demand Curve Worksheet

Sometimes in the real world one cannot change the demand for a product by simply lowering or raising the price. Traditions, income, personal preferences (John Deere), season of the year (Xmas tree, Dec. 26), religion, and environmental (ice cream in January vs July) factors often influence demand. However, if you were selling a product what is your best resource available to you that could increase the demand for that product?

____(Write in your answer)

PROBLEM 1

A machinery manufacturer is trying to decide if his/her company should undertake an advertising campaign in an attempt to create more demand for his/her machinery. What he/she is really attempting to do through advertising is to increase demand and establish a new demand curve. The demand curve chart below shows the results.



QUESTIONS??

1. Is the demand for the tractors higher or lower after the advertising?
2. Prior to the advertising campaign, how many tractors were sold with the price at "P"? ______ After the campaign? _____
3. If the price is higher than "P", would more or less units be sold?
4. If the price of a tractor was less than "P", would more or less units sell?
5. Can one always change the demand of a product by simply changing the price?
6. If the price was to remain the same, what would happen to the quantity consumed?

7. If the manufacturer had a desire to sell no more units of machinery, what would have to happen to the price in order to keep demand in line with the supply?

8. Was the last advertising campaign a financial success?

9. What happens to the demand curve as demand increases?

10. Is advertising a part of the marketing process? Is it productive? Is it necessary?

Understanding Supply

PROBLEM I

Construct a supply curve using the following data:

Price of Wheat/Bushel	Quantity Sold/Unit of Time
4.80	1510
4.60	1320
4.40	1150
4.20	1020
4.00	920
3.80	860
3.60	840
3.40	830

Wheat Supply Curve

Price Per Bushel

4.80
4.60
4.40
4.20
4.00
3.80
3.60
3.40

800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800

Million of Bushels of Wheat Sold or Produced

QUESTIONS??

1. Which direction does the normal supply curve slope? (All will slope same direction but vary in angle of slope.)
2. What happens to supply as price of wheat goes up?
3. What happened to the quantity produced as price decreases?

PROBLEM II

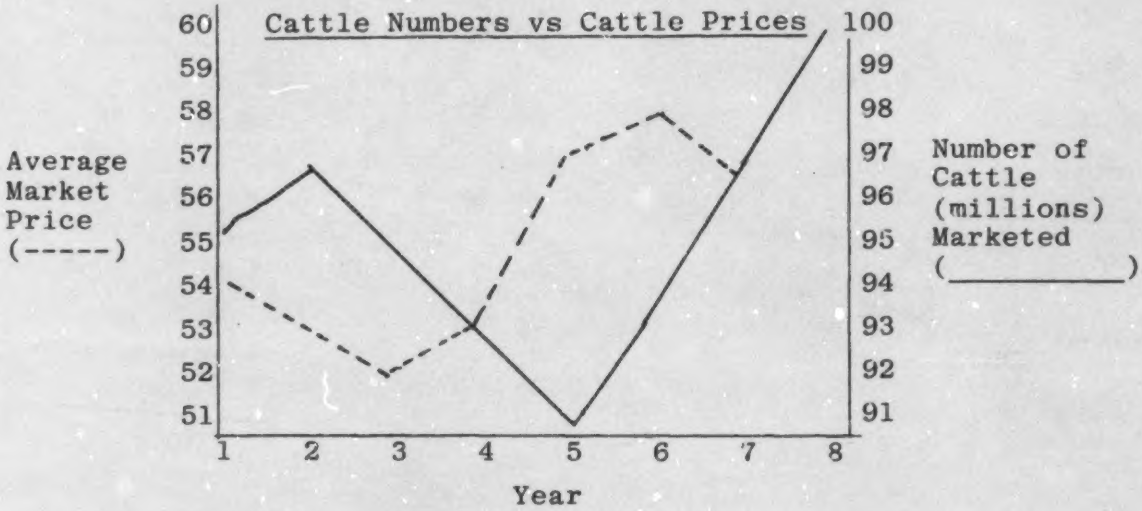
A new strain of wheat has been developed at O.S.U. that improves yield by 25 percent. Calculate increased yields and locate and connect them using a different color ink on the above supply graph.

QUESTIONS??

1. Prior to the introduction of the new wheat strain, how many bushels were sold or produced at $4.20?
2. With the new strain, how many bushels at $4.20?
3. In which direction did the new supply curve shift? Why?
4. What might happen if a strain of barley produces more bushels than wheat?
5. What might happen to wheat supply if barley price doubled?
6. What would happen if the supply of wheat in storage was sold to a foreign country?
7. How is supply of a product affected by the demand for that product?
8. What factors affect the supply of a product?

Supply and Price Worksheet

An Ag Loan Agent is concerned with how market cattle prices are going to hold up in the future. This knowledge assists him/her in helping his/her customers arrive at proper management decisions. You, as an Ag Economist Specialist, have been asked to interpret the chart and answer the questions the agent has.

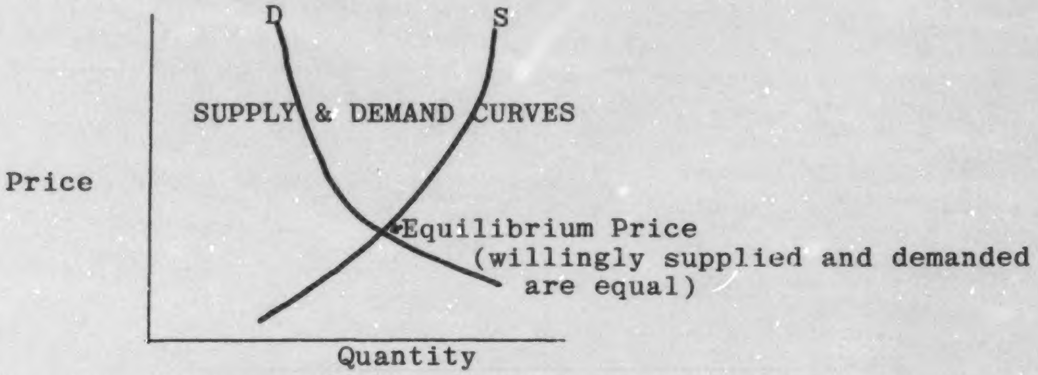


QUESTIONS??

1. Does the number of market cattle vary from year to year?
2. Generally, is the per capita consumption (demand) for beef changing?
3. When were cattle prices lowest in relation to cattle numbers?
4. When were cattle prices highest in relation to cattle numbers?
5. What is happening in the above two questions to reach those conclusions?
6. Using the chart, what happened to cattle prices reflected in year 8?
7. From a marketing standpoint, will reducing supply increase prices?

LAW OF SUPPLY AND DEMAND

(applies where there is a free market)



SUPPLY - as the price of a commodity increases, the supply increases or as the price decreases, the supply decreases.

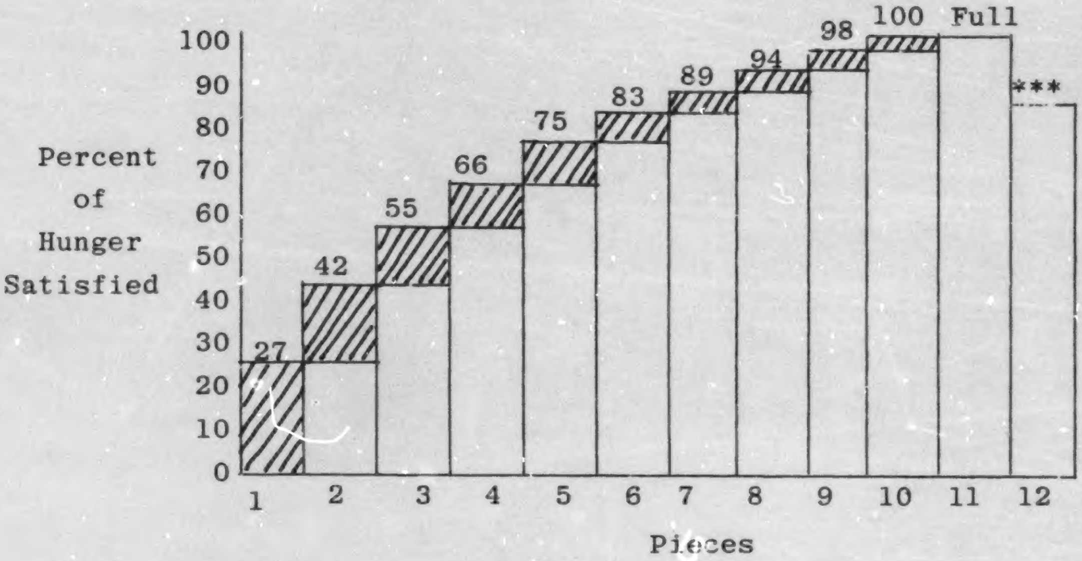
DEMAND - as the price of a commodity increases, the demand decreases or as the price decreases, the demand increases.

Understanding Diminishing Returns

I. Leading Questions?

How many of you eat pizza?
How many pieces can you eat?
How many pieces does it take to get filled?
Which piece tasted the best? The first one or last one? Why?
Is there a point where additional pieces may make you feel uncomfortable?

Let's now talk about this on a chart of a student's hunger satisfaction with each piece of pizza.



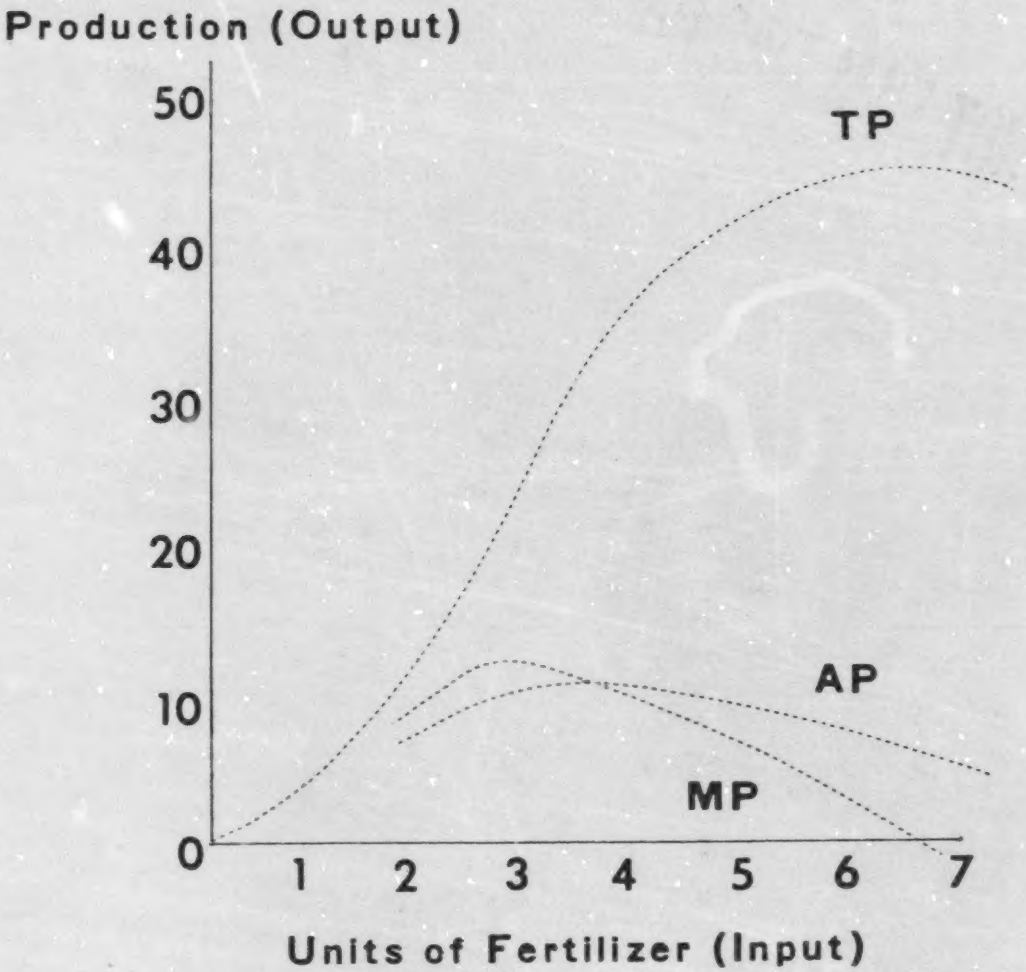
▨ - Amount of satisfaction added by each piece.
*** - Negative Satisfaction

II. Conclusion Questions??

1. Which pieces gave the most satisfaction?
2. Should we stop after the first few pieces since they give the most satisfaction?
3. What was gained by eating more pieces?
4. Did the 11th piece still give some added satisfaction?
5. Was it worth the effort to take more pieces up to the 11th?
6. Was there a piece that gave less satisfaction than the one before? Where?
7. For the greatest total satisfaction, where should he/she stop eating pieces?

NOW, to better understand the principle, let's call each piece of pizza a unit of input and the hunger satisfaction a unit of output. Look at the chart and notice the added amount of satisfaction of the student's hunger (MR) diminishes as he/she nears the full mark. In other words, for each added unit of input, the added output is diminished or reduced. Also, at a certain point (100 percent full), the output or satisfaction becomes negative with each additional piece (input). Thus, the Law of Diminishing Returns!!!

LAW OF DIMINISHING RETURNS
(Hypothetical)



TP= Total Products

AP= Average Products

MP= Marginal Products

Diminishing Returns Worksheet

I. Agricultural Application.

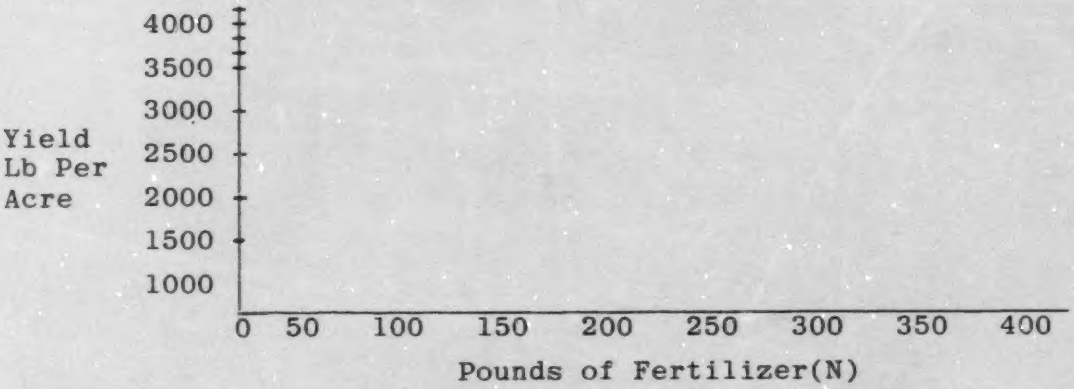
A. Effects of Nitrogen Fertilizer on Wheat.

1. Will adding fertilizer effect the yield?
2. How much should be applied/acre?
3. Is there an amount that will give us the best yields?
4. Can we apply too much nitrogen?

B. Yield Table (Hypothetical).

Lb of N/A	Yield Lb/A
0	1000
50	1500
100	2200
150	3100
200	3600
250	3800
300	3900
350	3950
400	3800

C. Construct a Diminishing Returns Curve with the above data.



QUESTIONS??

1. What happened as more N was applied?

2. What other inputs besides N might increase yields?

3. How much increased yield was received from the first 50 lb of N?

4. What was the yield difference between the first and second 50 lb of N?

5. What was the yield difference between 250 and 300 lb of N applied?

6. Did the last 50 lb of N give as much of a yield increase as the first?

7. Eventually, what happened to the increase in yield with each additional 50 lb unit of N added?

8. The rate of increase in yield begins to __________ or __________ as more units of inputs were added, thus the name - "LAW of __________________________ __________________________."

Marginal Units Exercise

A. Definition - Marginal is an added or additional unit.

B. Types:

1. Marginal inputs (costs).
2. Marginal outputs (returns).

C. Examples:

1. Marginal Cost (M.C.) 0 the cost of producing an additional unit.
2. Marginal Return (M.R.) - the return from an additional input unit.

**Principle - Maximum Profit Point is where MC = MR !!!

D. Complete Marginal Columns in Wheat Chart.

Lb Fert.	Added or Marg. Input	$10/50 lb Marg. Cost	Yield	Added or Marg. Output	$10/cwt Marg. Return
0	0	0	1000	0	0
50	50	$10	1500	500	$50
100	___	___	2200	___	___
150	___	___	3100	___	___
200	___	___	3600	___	___
250	___	___	3800	___	___
300	___	___	3900	___	___
350	___	___	3950	___	___
400	___	___	3800	___	___

E. QUESTIONS??

1. Is the marginal yield from 300 lb as great as the marginal yield from 50 lb? Why?
2. Does the marginal cost differ? Why?
3. Does the marginal return differ? Why?
4. Where would one stop applying fertilizer if we were only concerned with total yield or physical product (no costs involved)?
5. Where would one stop to produce the greatest economic returns? Why?
6. At what fertilizer level does MC = MR?

F. Marginal Returns Types:

1. Increasing

Units of Input	Units of Output	
1	1	
		> 2
2	3	
		> 3
3	6	
		> 4
4	10	
		> 5
5	15	

2. Constant

Units of Input	Units of Output	
1	2	
		> 2
2	4	
		> 2
3	6	
		> 2
4	8	
		> 2
5	10	

3. Decreasing

Units of Input	Units of Output	
1	5	
		> 4
2	9	
		> 3
3	12	
		> 2
4	14	
		> 1
5	15	

Farm Business Management

Marginal Units Worksheet I

I. Costs and Returns from applying Nitrogen Fertilizer to One Acre of Oats:

Pounds of N	Total Fertilizer Cost	Pounds of Oats	Total Returns Oats @$5 per cwt	Marg. Cost	Marg. Return
0	$---	1000	$ 50.00		
15	6	1600	80.00		
30	12	2000	100.00		
45	18	2300	115.00		
60	24	2500	125.00		
75	30	2650	132.00		
90	36	2770	138.50		
105	42	2850	142.50		

How many pounds of nitrogen fertilizer should the farmer apply?________

II. Most Profitable Application of Water on Corn Silage in the Willamette Valley:

Acre Inches Water Applied	Total Water Cost @$5 per inch	Tons of Silage	Total Returns Silage @$20/T	Marg. Cost	Marg. Return
7	$35	15	300		
8	40	17	340		
9	45	19	380		
10	50	21	420		
11	55	22	440		
12	60	22.5	450		
13	65	22.75	455		
14	70	22.9	458		

How much water should be applied? ________________

III. What is the point where MC = MR?

Equimarginal Principle Exercise

Equimarginal returns is closely tied to the law of diminishing returns. This principle states that one should allocate a resource among its several uses in such a way that the marginal (added) returns are equal in all uses. In other words, with limited resources, one should divide land, labor and capital among different enterprises to produce the greatest income from that resource. The last dollar spent on an enterprise should yield a marginal return exactly equal to the return earned by the last dollar spent on all other enterprises.

Example: If $100 spent on buying feed will return more than $100 spent on fertilizer, additional feed should be purchased until the last dollar spent on feed will return exactly the same as the last dollar spent on fertilizer. Of course, if the farmer has unlimited capital he/she will spend until marginal costs equal marginal returns.

PROBLEM I

Suppose a farmer has $600 to spend for fertilizer. The table below shows the dollar outputs from each of these crops for each additional $100 fertilizer used.

Fertilizer Investment	Returns From Crops Corn	Hay	Oats
1st $100	$300	$325	$250
2nd $100	$285	$275	$225
3rd $100	$240	$225	$175
4th $100	$200	$175	$100
5th $100	$150	$100	$ 75
6th $100	$100	$ 50	$ 25
Total returns from $600 investment	$1275	$1150	$850

QUESTIONS??

1. What is MC = MR?

2. Circle the maximum profit point for corn, hay, and oats.

3. The use of the above situation should only be used under ________________ capital.

   **Unfortunately we have only $600 to invest in fertilizer. Using the equimarginal principle we can determine how to most profitably invest.

4. Where would you invest your first $100? (Highest return/$100 invested). Place a #1 by your choice.

5. The second $100 should be invested in the next highest return point. Place a #2 by that point.

6. Complete the next $400 the same way, marking their order of investment.

7. Which crop yields the least returns from the $600 investment?

8. Which crop yields the most returns from the $600 investment?

9. Draw boxes around those best investments of the $600 for fertilizer just completed for the various crops and add that total. $_________________

10. A good manager then made $__________ more by spreading out the $600 investment to the most profitable points than by spending all on one crop.

11. The main objective in business is not to just make a profitable return, but make the ________________ profitable return.

Farm Management Problems I

NAME ____________________

1. Suppose a farmer is growing potatoes and at harvest time he/she has fixed costs totaling $35,000. Assume that the costs of harvesting the 100 acres of potatoes in question average $275/acre. If potatoes are selling for $1.20 per cwt. and the expected yield is 250 sacks (each sack weighs 100 lb) per acre, should the farmer harvest his/her potatoes? Why or why not? Is the farmer maximizing his/her profits?

2. Given this information and assuming unlimited capital, other costs constant, and a condition of certainty, how many pounds of fertilizer would you apply? (Only 50 lb increments.)

Lb of Fertilizer	Yield in tons
0	1.8
50	2.6
100	3.1
150	3.5
200	3.8

a. If fertilizer cost 20¢/lb and the product was worth $30/ton? ____________________

b. If fertilizer cost 10¢/lb and the value of the product was $12/ton? ____________________

3. A farmer can only borrow $400 for chemicals to control weeds on 100 acres of corn, 100 acres of wheat, and 100 acres of barley. Previous weed control trials have indicated the following returns per $1 invested for chemicals:

	Corn	Wheat	Barley
1st $ 1	$2.50	$1.50	$1.25
2nd 100	2.25	1.25	1.00
3rd 100	1.75	.75	.50
4th 100	1.25	.50	.25

----How should the farmer distribute the $400?

4. Where should the farmer spray at with unlimited capital?

APPENDIX E

Opportunity Costs Example

**- Opportunity Costs

The opportunity cost of producing a commodity (say) cattle is the value of the most profitable alternative use of resources (say) sheep.

(What we lose by not producing something)
(Not actual out-of-pocket costs, but are real nevertheless)

Suppose a farmer has a 40 acre field that he/she is thinking of putting in oats. Assume the per acre cost of production is $50. The farmer believes he/she can produce 1.5 tons of oats per acre. The farmer should expect the following returns:

Costs

40 x 50 = 32,000

Returns

60T x $40 per ton = $2,400

Profit------------- $ 400

The farmer can make a profit but is this the most profit to be made? He/she can also grow barley on the land. Suppose his/her cost of producing barley was also $50 per acre, but that the yield is 1.25 tons and that the price of barley is $60 per ton, Then,

Costs

40 x 50 = 2,000

Returns

50T x $60 = 3,000

Profit------------ $1,000

The opportunity cost of growing oats is $3,000. On this basis if we look at the return and opportunity cost we see:

Opportunity Cost of Growing Oats

Return from barley-----------------$3,000
Return from Oats ---------------------$2,400
Loss-------------------------------$ 600

That is if we subtract $400 from $1,000 we get $600. The objective is not just to make a profit but to make the greatest profit.

Opportunity Costs Worksheet

PROBLEM I

A farmer has an opportunity to invest $10,000 of extra funds and wants to select the best use of the money to achieve the greatest net returns. The farmer has determined he/she has four choices to invest the money.

Choice 1 - Trade in present 10 ft. combine (1 year old) for a 14 ft. combine to harvest 60 acres of grain each year. By owning a 14 ft. combine the farmer can save two hours/A (labor $5/A) and thus do some custom combining worth $2,200. Additional expenses include: depreciation - $1,430; interest and insurance -$570; housing - $100.

Choice 1: Returns ________ - Expenses __________ = __________Net

Choice 2- Leveling a 50 acre field for better crop production. Presently this field is only suitable for pasture production. The value realized from this pasture is $24/A. By leveling, crop production can be increased to $72 net income/A. It is assumed that the leveling will last 10 years. (Don't forget to figure current income for pasture in expenses.)

Choice 2: Returns __________ - Expenses ________ = __________Net

Choice 3 - Build a silo on the farm. For the purpose of this example, it is assumed that silage replaces other feeds, thus no additional costs are listed for the value to the corn. By adding silage to the dairy ration, the farmer estimated that his/her dairy herd will produce 12,000 pounds more milk annually. Estimated expenses to fill the silo is $300/year. The silo is expected to last 20 years with no salvage value.

Choice 3: Returns __________ - Expenses __________ = __________Net

Choice 4- Hired extra labor. By hiring additional labor, it is estimated that production will be increased by $11,000 because of better timeliness of operation.

Choice 4: Returns __________ - Expenses __________ = __________Net

QUESTIONS??

1. Which choice of the $10,000 would bring the greatest net return?
2. What would be the percent to investment for each of the four choices?

Choice 1 -
Choice 2 -
Choice 3 -
Choice 4 -

HINT: $\frac{\text{Return}}{\text{Investment}}$

3. Could the farmer afford to borrow $10,000 at 9 percent interest to finance: (a) the hired man? _____; (b) buy combine? _____; (c) build silo? __.

4. If the farmer could get 5 percent interest on his/her savings from the bank, should he/she buy a combine or build a silo even if the funds are available?

5. Since the farmer had only $10,000 to invest, how many choices could he/she choose if each would cost $10,000?

6. What would he/she do about the other opportunities? When could he/she take advantage of the other opportunities?

7. If $20,000 is available, where would the manager invest his/her funds to realize the greatest net profit?

Farm Management Problems II

Name________________________

1. If one pound of soybean meal will substitute for 1.2 pounds of linseed meal of equal nutritional value and soybean meal sells for 5.2¢ per pound and linseed meal sells for 4¢ per pound, the livestock farmer who wishes to make the largest net profit should:

   a. feed 68 percent soybean meal and 32 percent linseed meal
   b. feed all soybean meal
   c. feed 20 percent soybean meal and 80 percent linseed meal
   d. feed all linseed meal

2. A farmer is able to produce 70 bushels of oats per acre with the application of 100 lb of fertilizer per acre. By varying only one factor of production, in this case the amount of fertilizer applied, he/she can receive a yield increase of 12 bushels per acre within the next 100 lb of fertilizer. The next 100 lb of fertilizer would result in an additional yield increase of 6 bushels per acre and the next 100 lb increase would result in additional 2 bushels per acre. If oats sell for 80¢ per bushel and the fertilizer costs $4 per hundred, how much fertilizer should be applied to maximize his/her net income?

3. Up to harvest time, a farmer has spent $10 per acre for labor, seed, and machine costs on oats. Price of oats has fallen, and a severe local drought has reduced his/her yields. With an anticipated price of 70¢ per bushel on an expected yield of 10 bushels per acre, what should the farmer do assuming he/she can harvest the oat crop for $3 per acre? What will be his/her economic loss?

4. Given: (assume all other costs are constant and each enterprise is equally uncertain)

	Marginal returns from fertilizer on:				Marginal returns from feed fed to:		
	Wheat	Barley	Corn	Beans	Hogs	Beef	Dairy
1st $100	160	120	150	110	120	95	210
2nd $100	150	110	150	105	120	95	180
3rd $100	130	105	140	105	120	95	150
4th $100	110	90	120	95	120	95	130
5th $100	110	80	110	95	110	95	120
6th $100	105	70	90	90	110	90	110

a. If operator only had $1,000 to spend on fertilizer or feed, on what inputs and enterprises should the money be spent to maximize profit? Show dollar amounts per enterprise.

b. If the farmer had unlimited capital, to what level should input be applied?

c. If you were a management consultant, would you recommend raising beef given the above data? Why?

Fixed and Variable Costs Example

Assume a farm has two enterprises, a 40 cow dairy and a 1,000 bird market egg flock. The labor force consists of a father and son fully employed. The father keeps enterprise records and at the end of the year made the following analysis of his poultry enterprise.

Costs

Grain layers and replacements	$5,500
Chicks	395
Repairs	50
Supplies	300
Interest depreciation taxes	495
Operator's labor (1200 hours)	1,200
	$7,940

Returns

Eggs	$6,720
Meat	750
	$7,470

On this basis it appears that the poultry enterprise is losing $470. However, let us reclassify the cost as fixed and variable.

Variable costs

Grain, layers and replacements	$5,500
Chicks	395
Repairs	50
Supplies	300
	$6,245

Fixed costs

Interest, depreciation, and taxes	$ 495
Operator's labor	1,200

If we view the problem in this way we can see that the farmer would have some of the cost whether he had the poultry enterprise or not. We assume that he is taking good care of his dairy cows and has no other good use of his labor. Therefore,

Returns	$7,470
Less variable costs	6,245
	$1,225

If interest, depreciation and taxes go on even if he doesn't have a poultry enterprise, we can see he is getting $1.02 per hour of labor or a total of $1,225 that he would not otherwise have.
($1,225 - 1,200 - $1.02 per hour.)

Remember, "variable costs" are decision making costs.

Costs Worksheet

1. Define:

-Fixed Costs-

-Variable Costs-

T or F

2. ____For some economic decisions fixed costs are not relevant.
3. ____Fixed costs under careful management can become variable costs.
4. ____Variable costs are decision making costs.
5. ____Generally, the shorter the time period the greater the fixed costs.
6. ____One should harvest a poor crop if one can make more than harvest costs.

PROBLEM

Mr. Jones has $50,000 in capital available to invest. He would like to buy 30 acres for $30,000 to produce sugarbeets. He would need to invest another $15,000 for machinery and equipment. This would leave him $5,000 to purchase fuel, oil, grease, repairs, seed; fertilizer, chemicals, etc. He decides to chart out the costs.

Effects of Fixed and Variable Costs

Fertilizer Applied/A @ 10.75¢/lb	Yield/A $4.10/cwt	Rent/A	Rent/lb	Fertilizer Cost/A	Fertilizer Cost/lb	TOTAL Cost/lb
0	1000 lb	$52	____	____	____	____
40	1500	$52	____	____	____	____
80	2000	$52	____	____	____	____
120	3000	$52	____	____	____	____
160	3500	$52	____	____	____	____
200	4000	$52	____	____	____	____

1. Fill in the blanks in the above chart.
2. Does Mr. Jones have any fixed costs before he makes any purchases? ________
3. After the purchase of land, machinery and equipment, did these costs become fixed costs? _____

4. Would the cost of seed, fertilizer and chemicals be fixed or variable up to time they were actually purchased? __________ After purchased?_________

5. Will he have to pay interest, taxes, insurance and depreciation on the machinery and equipment purchased whether he raises sugarbeets or not? __________

6. Did the fertilizer cost/lb increase as more fertilizer was added? __________

7. Would it always pay to add more fertilizer? _____ Why?

8. Does the rent cost/lb decline as the yield increases? _______ Why?

9. Are fixed and variable costs affected the same when production is increased? __________

10. Did the total cost/lb continue to go down as yield increased? _________ Why?

Farm Management Problems III

Name________________________

1. By diversifying crop enterprises rather than specializing in one major crop, the farmer will:

   a. reduce risk and uncertainty
   b. decrease annual labor efficiency
   c. justify the cost of more labor saving equipment
   d. concentrate production knowledge

2. Commercial fertilizer should be applied to crops as long as:

   a. the added production returns increase gross farm income
   b. the added fertilizer maintains soil productivity
   c. the added production returns are more than the added cost of the fertilizer
   d. the added fertilizer increases crop yields per acre

3. In analyzing the farm business, depreciation should be considered as:

   a. a variable cost
   b. a fixed cost
   c. an opportunity cost
   d. an operating cost

4 Assuming that a farmer is efficiently managing his/her farm business, the last dollar spent on a factor of production, such as seed, fertilizer, machinery, or buildings will yield a marginal or added return:

   a. greater than the last dollar earned from all other factors of production
   b. exactly equal to the last dollar earned from all other factors of production
   c. less than the last dollar earned from all other factors of production
   d. almost as much as the last dollar earned from all factors of production

5. What is the economic principle where a farmer is raising beef cattle with low beef prices, and can make a transfer to sheep with little problems, when lamb and wool prices are very favorable, but refuses to make the change:

   a. marginal costs and returns
   b. opportunity costs
   c. law of diminishing returns
   d. fixed and variable costs

6. It is profitable for a farmer to borrow money to expand his/her farm business when the borrowed money:

    a. returns more than the cost of borrowing the money
    b. can be secured at a low rate of interest
    c. can improve the level of production
    d. will increase volume of business

7. Every farmer operates his/her farm to make money. In doing so, a farmer has to combine his/her land, labor, and:

    a. fertilizer
    b. equipment
    c. feed
    d. capital

8. If the farmer believes his/her most limiting resource is capital, he/she would probably:

    a. consider the return per unit of capital when selecting enterprises
    b. substitute capital for labor in the production process
    c. make sure he/she is on good terms with all credit agencies
    d. consider medium to low capital requirement enterprises to maximize profit

APPENDIX F

Enterprise Combination Worksheet

PROBLEM I

Using the following data, decide whether to raise sheep or beef brood animals on the farm you are managing.

Resource Needs of Sheep and Beef Animals

	Labor	Capital	Acres of Pasture	Net Profit
1 ewe	4 hrs.	$150	.2 acres	$ 7.50
1 cow	13 hrs.	$790	1.0 acres	$33.00

a. Calculate which competes best for labor (compare with net profit)

Sheep $__________________/hr.

Beef $__________________/hr.

b. Calculate which competes best for pasture.

Sheep $__________________/A.

Beef $__________________/A.

c. Calculate which competes best for capital.

Sheep $_______________/$1 invested

Beef $_______________/$1 invested

1. Was the beef most competitive for all factors of production?
   ____

2. Was sheep?_________________

3. On the basis of the above problem, which enterprise should be raised?_____________

4. Why must one choose between beef or sheep?

5. Why can beef and sheep be substituted for each other?

6. What type of enterprise combination exists here?

7. What is the basis for determining which enterprise to raise?

8. What economic principles were applied in this problem?

9. Are there ever any situations where one might not raise the most profitable enterprise?

Enterprise Combination Worksheet II

PROBLEM II

After further consideration of the choice between sheep or beef on the farm, you find that the net profit of each is affected by the size of the enterprises. Generally, as the size of an enterprise increases efficiency decreases due to greater competition for time, machinery, management, etc. Thus, the fewer the animals or acres in each enterprise, the greater the efficiency. With this in mind it often is more profitable to combine enterprises.

You discover that your pasture limits the total number of livestock units to 30. (Livestock Unit = 5 ewes or 1 beef cow.) Thus, 30 animal units equals 150 ewes or 30 beef cows. Using the data below, determine the most profitable combination of sheep and beef cows for the farm.

Combination of Cows and Ewes	Beef Net Income	Ewe Net Income	Combination Income
0 cows - 150 ewes	$ 0	$1000	$1000
10 cows - 100 ewes	$330	$ 720	$______
20 cows - 50 ewes	$650	$ 375	$______
30 cows - 0 ewes	$990	$ 0	$ 990

QUESTIONS??

1. Is the profit from various combinations of cows and sheep constant? ____________
2. Which combination of sheep and beef was the most profitable?
3. Why might the rates of substitutions of one enterprise for another be known before the best choice can be made?
4. Why did a combination of enterprises give a higher net profit than either sheep or beef alone?

PROBLEM III

After you make a choice between beef or sheep you find that you have more than enough labor to care for the animals that your pasture will support. Your land and capital are used to capacity, but you have extra labor.

Analyzing the situation and noticing the small shed suitable for farrowing sows, you decide to purchase five bred gilts to farrow out.

QUESTIONS??

1. What additional resources would be needed by adding a brood sow enterprise to the ewe-cow program?

2. What type of enterprise combination is this example?

3. Why is the sow enterprise not competitive?

4. What are some other enterprises that would have easily worked in this example?

5. Since operating larger than five sows is generally more efficient, why not add say 30 sows instead of just five?

6. Would the cost of the unused resources for a supplementary enterprise be the same as for a competitive enterprise?

7. Can a supplementary enterprise expand sufficiently to eventually become a competitive enterprise?

Enterprise Combination Worksheet III

PROBLEM IV

Leaving the sheep and beef combination problems, we now consider a competitive relationship of two crop enterprises.

Remember, you have 200 acres of crop land on which to decide to plant either barley or wheat or combination of both. Base your enterprise decisions on the data below.

Income From Wheat and Barley

Acres	Wheat Yield	Income	Acres	Barley Yield	Income	Total Income
50	3000	$12,375	150	4000	$33,000	$45,375
100	3000	$24,750	100	4500	$24,750	$______
150	2500	$30,937	50	4500	$12,375	$______

QUESTIONS??

1. What type of enterprise combination is this example?
2. Which combination returned the maximum income?
3. Did the yields vary as acres of either crop were changed? Why?
4. Why might it be advantageous to raise a combination of crops rather than raise all just one crop?

PROBLEM V

After establishing an acceptable combination of crop enterprises and livestock enterprises, you begin to look for livestock and crop enterprise combinations that will generate even greater returns. Analyzing your crop selection, you realize that there are crops other than grains that yield higher returns per acre. Looking over the sheep enterprise, you discover that more ewes could be raised with additional supplemental pasture.

With this in mind and no conflicts existing with an obvious choice, one would select a grass seed enterprise as the answer to both areas.

	Wheat Alone	Grass Seed Alone	Sheep Alone	Combined
Net Income	$50/A	$100/A	$35/A	$120/A

QUESTIONS??

1. What type of enterprise combination is this?

2. If you want to grow wheat, why complicate it by growing grass seed?

3. Would this type of enterprise combination change if it were difficult to combine labor and machinery to harvest the grass seed and wheat? What would it be?

4. What would happen if legumes would be added to the crop program?

Farm Management Problems IV

Name________________________

1. A dairyperson comes to you for some help after he/she had heard that you knew something about farm management. His/her herd average is 9600 lb/cow. He/she says he/she has enough forage, barn space, labor, and equipment for four more cows. He/she knows four cows of his/her neighbors pretty well and that they are for sale. He/she estimates the cows will be productive for about four years after which they will be worth $100 each for slaughter. The neighbor is asking $260 for each cow.

   The dairyperson would plan to feed each cow about 2400 lb of grain and 4½ tons of hay and some pasture per year. He/she estimates these cows will produce 8400 lb of milk/cow/year.

   If he/she buys the cows he/she will have to borrow the money and pay 8 percent interest on it. He/she can sell surplus hay at $20/ton but cannot make any use of the other resources. Grain will cost him/her 3¢ a lb. He/she can sell all the milk he/she can produce for $3.40/cwt. after the hauling charges have been paid.

   His/her cost account records provide him/her with the following information:

   a. Housing and equipment costs - $32/year/cow
   b. Overhead - $20/cow/year
   c. Vet., medicine and breeding costs - $15/cow/year
   d. Owner labor @ $1.50/hr. for 100 hrs., i.e., $125/cow/year

   On the basis of the above information, would it be profitable to buy the cows? By how much? (Show your work)

   What, if any, other costs or returns that should be included?

   Using the following data, determine the number of units of water and the units of fertilizer you would use with the following cost and price relationship. Capital is unlimited.

1st unit of water - $15 each additional unit of water - $6	1st unit of fertilizer - $8 each additional unit of fertilizer - $4

Value of product - $1/unit

Inputs of water	Inputs of fertilizer				
	0	1	2	3	4
0	14	70	36	36	36
1	26	90	96	102	105
2	24	88	105	115	119
3	17	86	106	120	124
4	7	82	104	116	124

__________units of water   _____________units of fertilizer

APPENDIX G

Budget Worksheet I

QUESTIONS??

1. What is a budget?

2. List some advantages of budgeting.

   a.

   b.

   c.

   d.

   e.

3. List some budget types.

   a.

   b.

   c.

   d.

4. With the following information, complete the following enterprise budget.

Wheat Budget
(100 acres)

Estimated Receipts	Estimated Expenses
Yield - 110 bu/A Price - $4/bu. Machinery Depreciation Value (wheat share) - $24,000 (Closing Inventory)	Opening Inventory - Machinery - $25,000 Fuel and oil - $10/A Machinery repair - $1/A Seed - 120 lb/A @ $180/T Fertilizer - Avg. price $250/T 200 lb (16-16-16)/A 100 lb (Urea)/A Chemicals - Karmix and 2-4D - $5/A Labor - $15/A Land Rental - $40/A Custom Combining - $25/A

BUDGET FOR ________________________________ ENTERPRISE

Estimated Expenses:

	No. or Amount	Price Per Unit	Total Value
1. Total of Opening Inventory			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13. Total Estimated Expenses			

Estimated Receipts:

	No. or Amount	Price Per Unit	Total Value
1. Total of Closing Inventory			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13. Total Estimated Receipts			
14. Total Estimated Expenses (Item 13, Estimated Expenses)			
15. Estimated Labor Income			

The Partial Budget

A Tool for Estimating Income Effects of Management Changes

Will it pay? When considering a change in farm organization or practice, the big question usually is: Will the change pay? Progressive farmers are constantly considering alternatives and making choices they hope will increase their incomes. Whether the problem is large or small, it still brings up the question: Will it pay? With increased mechanization and higher production costs on farms, more dollars and cents figuring is needed. In most cases this means comparing expected increases in income against expected increases in cost that would result if the proposed change was tried. This process of comparison is referred to as budgeting. It figures the probable result out on paper before spending money.

Partial Budget Often Best Tool: Fortunately, most farm decisions involve only a moderate change in over-all management. Changes of this type don't require complete farm budget calculations to estimate effect of the change on net farm income. Which of the possible choices open will increase net farm income most (or decrease it least) is the answer wanted. Such questions as the estimated effect of (1) adding to an enterprise, (2) introducing a new one, or (3) a change in practice are typical of problems referred to.

PARTIAL BUDGET OUTLINE:

Additional receipts - expected additional returns for products sold and services rendered as a result of the change under consideration. Sub-Total: $________

Reduced costs - estimate of annual costs which will no longer be incurred if the changes are made. Sub-Total: $________

Additional Receipts Plus Reduced Costs: $________

Additional costs - additional direct costs that would occur in a year's business as a result of the change. Sub-Total: $________

Reduced receipts - returns that will no longer be received after the change has been made. Sub-Total: $________

Additional Costs Plus Reduced Receipts: $________

Difference (Change in Net Income): $________

Prices, Values, Yields: For prices and values, present quotations modified by outlook information, should be used. The best place to determine probable yields is from past experiences on the farm in question or on similar neighboring places that use the practice in question.

Partial Budget Worksheet

PROBLEM I

You have been hiring custom combining for 80 acres of crops for $5 per acre. You can rent a self-propelled combine for $4.25/acre but will need to furnish your own fuel, oil, and grease estimated at 35¢ per acre.

Assume your labor to be worth $1.50/hour because of other uses at this time, with .4 hour of labor needed per acre. You feel that you will be able to get an additional $1 worth of crops per acre by operating the machine yourself rather than hiring the job done by a custom operator.

What is the estimated effect on net income if you change from custom hiring to renting?

Partial Budget

Additional Costs	Additional Returns
Reduced Returns	Reduced Costs
A. TOTAL Additional Costs	B. TOTAL Additional Returns

Net Change in Income (B minus A)__________

PROBLEM II

A farmer has one tractor but is considering purchasing a smaller one, along with a cultivator, because: (1) his son, who has no alternative use for his labor, can do custom cultivating of 400 acres of corn for neighbors, and (2) the smaller tractor will be more economical for light work.

The small tractor will save 100 gallons of fuel annually, at a price of $1/gallon, over the present tractor in performing light work. The estimated fuel cost for cultivating is 50¢ per acre.

The tractor will cost $5,000 and will have annual costs of 18 percent per year for the usual fixed costs plus repairs. The cultivator will cost $500 and have annual cost of 16 percent of new cost. The custom cultivating will return $2 per acre.

What is the estimated change in annual income with the new tractor?

Partial Budget

Additional Costs	Additional Returns
Reduced Returns	Reduced Costs
A. TOTAL Additional Costs	B. TOTAL Additional Returns

Net change in income (B minus A)______________

Should the farmer buy the new small tractor?_______________

Cash Flow Budget Data

Estimated cash on hand - $1,000.00

Income:

Wheat -	Jan	May	Sept
$120/T	100T	80T	180T

Alfalfa -	May	June
$100/T	50T	25T

Market Hogs - 25 hd./month at $100/head

Lambs -	June	July	
	100 lambs	50 lambs	at $50/head

Expenses:

Wheat seed - 8,000 lb at $180/T - Due Dec. 1

Alfalfa seed - 500 lb at $2/lb - Due July 1

Fertilizer - $250/T
April 1 - 10T for Wheat
May 1 - 2T for Alfalfa and Pasture
Nov. 1 - 4T for Alfalfa and Pasture
Dec. 1 - 10T for Wheat

Irrigation - July $200 / Aug. $200 / Sept. $200

Spray - Kermix - Dec. $500
2-4D - June $250
Vet. Medicine - $25/month except $100 for Dec.

Repairs - July $2,000
Dec. $5,000

Equip. Payments - Nov. $5,000

Living Expenses - $750/month

Taxes - June $2,000
Dec. $1,000

Fuel - March, June, Sept., Dec. - $500 each month

Rent - Sept. $5,000

Insurance - Fire, Liability, and Property - $100/month

Storage and Cleaning - Dec. $100

Feed - $3,000/month

Interest - Dec. $1,000

Utilities - $100/month

*Complete the Cash Flow Budget with the above information.

CASH FLOW BUDGET

NAME ______________________________ YEAR ______________________

Ag IV - VII - 108

Income (estimate unit price)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Cash on hand at beginning of year													
TOTAL													
EXPENSES													
Seed													
Fertilizer													
Labor													
Water													
Spray and Medicine													
Repairs													
Equipment Payments													
Living Expense													
Taxes													
Gasoline and Oil													
Rent-Pasture-Farm													
Insurance													
Storage-Cleaning													
Feed Requirements													
Interest													
TOTAL													
Net C[illegible] Gain (Loss)													
Cumulative Total													

APPENDIX H

Calculating True Interest

FORMULA:

$$\frac{\text{Total finance charge}}{\frac{1}{2}\text{ of loan}} \times \frac{\text{No. of payments}}{\text{No. of years}} \times \frac{1}{\text{No. of payments}} \times 100\% = \text{True Interest}$$

EXAMPLE: Assume one purchased four tires for $100 and agreed to make 12 monthly payments of $9.42 each.

($9.42)x(12)=$113.04
Amount of loan-$100
Total finance charge - $13.04

Using above formula

$$\frac{\$13.04}{\$50.00} \times \frac{12}{1} \times \frac{1}{13} \times 100\% = 24.1\% \text{ interest}$$

Calculating Annual Percentage Rate

FORMULA:

$$\text{APR} = \frac{6 \times m \times C}{3P(n + 1) + C(n - 1)}$$

m = number of payments per year
C = dollar finance charges
P = amount of money borrowed or financed
n = total number of payments

*A formula which closely approximates APR is:

$$\text{Rate} = \frac{6 \times m \times C}{3P\ (n + 1)}$$

EXERCISE:

Joe Jones wants to buy a used pick-up truck. He can get one for $3,000. After talking to three different lenders, he has the following repayment options:

Lender A - Joe puts down $600 of his own money and makes four semi-annual payments of $660.

Lender B - Joe puts down 10 percent and the finance company will allow Joe to repay the loan in 15 monthly payments of $200 each.

Lender C - Joe puts down $600 of his own money. He is to repay the $2,400 loan in 24 monthly installments of $116 each.

What is the interest rate (APR) paid on each financing arrangement?

Financial Statement Worksheet

Information:

Inventory

Machinery - $10,000

Feeder Cattle - 5,000

Wheat in Storage - 5,000

Buildings - 5,000

Lot in Town - 8,000

Fuel, Fertilizer - 500

Land - 50 acres valued at $2,000/A.

Other

1. 1,000 in checking
2. Paid $500 on next year's fert.
3. $50 still due on pickup sold to a kid
4. Valley Fert. and Feed Acct. - 5,000
5. $1,000 in savings
6. $1500 worth of bonds
7. Operating loan due 10-2,-2,000
8. Greenline Hardware Account - 500
9. Awful Fuel Co. - 500
10. Balance on mortgage - 25,000 (before annual payment)
11. Annual mortgage payment - 6,000
12. Equipment loan - 5,000 balance before annual payment
13. Annual equipment loan payment - 2500
14. Mother-in-law holds $1,000 note (due this year)

PROBLEM:

With the above information complete the financial statement.

Financial Statement

Date________________

ASSETS

1. Cash, checking accounts, savings $________
2. Farm notes & accounts receivable ________
3. Market Livestock ________
4. Crops on hand ________
5. Value into grading crops ________
6. Farm supplies and prepaid expenses ________
7. Non-farm assets ________
8. Total Current Assets ________

9. Machinery & equipment ________
10. Breeding livestock ________
11. Investments (Co-op) ________
12. Land ________
13. Building & improvements ________
14. Other ________

15. TOTAL ASSETS ________

LIABILITIES

16. Accounts Payable $________
17. Notes Payable ________
18. Equipment Payment (due within 12 months) ________
19. Real Estate Payment (due within 12 months) ________
20. Other ________

21. Total Current Liabilities ________

22. Mortgages and contracts (on real estate due after 12 months) ________
23. Equipment contracts (due after 12 months) ________
24. Other ________

25. NET WORTH $________

26. TOTAL LIABILITIES & NET WORTH $________

Net Worth and Capital Ratio Worksheet

Information:

Land - 240 acres - $160,000
Midway Feed Co. Acct. - 1,225
Buildings - 11,000
Hopeland Lumber Co. Acct. - 190
Machinery - 12,450
Cash - 165
Fed. Land Bank - $60,000
Anything Equip. Co. - 3,400
Supplies (on hand) - 862
Cattle (39 head) - 4,590
Accounts Receivable - 1,000
Sheep (102 head) - 2,080

PROBLEM

With the above information, determine the answers below.

ASSETS

LIABILITIES

1. TOTAL Assets ________________

2. TOTAL Liabilities ____________

3. NET WORTH ______________

4. Net Profit ________________

5. Net Income _____________

6. CAPITAL RATIO ________________

Assets & Liabilities Exercise I

Johnny Profit wants to farm after he gets out of school and has started getting established. He currently rents a 60-acre crop land tract and has a 10-sow operation. He has been using his dad's machinery in the past but is considering the purchase of some used equipment this year.

Johnny presently lists the following assets and liabilities:

Item	Value
1968 pickup	$ 800
Loan on pickup	340
10 A-frame farrowing houses	1,300
Feed on hand	260
Wheat held for sale in storage (200 bu.)	450
Accounts payable for feed	100
Loan on sows	600
10 sows	1,100

1. If Johnny were to develop a financial statement (balance sheet) for his farming project he would list assets of:

   a. $4,010
   b. $2,870
   c. $3,460
   d. $3,910

2. Johnny's present net worth (equity) in his farming project is:

   a. $1,040
   b. $2,420
   c. $2,870
   d. $3,910

3. Johnny might include as current assets:

   a. The pickup
   b. 10 farrowing houses
   c. Accounts payable
   d. Feed on hand

4. Johnny has established a goal of being solvent, liquid, and profitable. Which asset is most liquid for Johnny?

   a. Hog houses
   b. Wheat in storage
   c. Pickup loan
   d. None of these

5. Johnny appears to be solvent at the present time. A farmer is solvent if:

   a. He/she has sufficient current assets to cover current debts
   b. He/she has sufficient equity to cover current debts
   c. He/she has sufficient assets to cover all debts
   d. He/she can pay all debts with all equity

6. A good definition of assets is:

   a. Anything that can be sold to generate dollars
   b. Money and equipment of a business
   c. Securities, bonds, and land owned by a business
   d. Only current and fixed assets

7. What are liabilities?

   a. Only debt obligation on land
   b. Any claim against the business
   c. Secured and unsecured loans
   d. None of the above

8. A balance sheet is:

   a. The same as a net worth statement
   b. A summary of the owner's financial position
   c. Both A & B
   d. None of the above

9. Information found in the financial statement is needed to compile:

   a. Solvency ratio
   b. Debt-equity ratio
   c. Current equity ratio
   d. Equity to net worth ratio

10. Which one of the following is not a purpose of preparing a financial statement?

   a. Show relative amounts of debt and equity
   b. Provide data for computing profitability of your business that year
   c. Measure your progress this year versus last year and previous years
   d. Indicate the profitability of a business and its current equity ratio

Farm Management Information

You own or are buying a 160 acre farm in Anytown, U.S.A. that is valued at $1,500/acre. The annual mortgage payment is due on Feb. 1 each year with a $10,000 payment and a balance of $50,000. You also lease 100 acres for $50 cash rent that is due each Dec. 10. You also have a machinery loan for $25,000; annual payment is $5,000. The farm owes a note of $5,000 to Producers Help Loan Co. You have a $50,000 life insurance policy with a cash value of $10,000. You maintain $1,000 in savings. You own some stocks worth $5,000. The farm still owes (past due) $10,000 to Area Feed and Seed Co.

Livestock Inventory	Crops
10 hd. Feeder Cattle @ $400 each	On Hand
100 Ewes @ $50 each	100T of Corn @ $105/T
2 Rams @ $100 each	50T of Wheat @ $110/T
20 sows @ $200 each	30T of Hay @ $50/T
1 Boar @ $300	
100 Stock Hogs @ $80 each	Growing
	100 A. of Wheat
	20 A. of Alfalfa
	20 A. of Clover

With this information, complete the financial statement.

APPENDIX I

Using skills developed in the unit, the cooperator should be able to work the following income tax estimate sheet:

During this current tax year, you sold $40,000 worth of cattle that you raised out of your herd. You sold 7,500 bushels of wheat for $3.00 per bushel. You also purchased $10,000 worth of feeder cattle and resold them later in the year for $17,000. You incurred expenses of $1,000 for labor hired to help you get your wheat harvested. You spent $2,000 for repairs on machinery and equipment during the year. Veterinary bills for the year totaled $1,200. You paid $1,500 in rent on pasture this year. Seed costs were $1,600. You also applied fertilizer on your wheat at a cost of $5,000. You paid $500 in trucking costs to get your cattle to market. Feed costs for the cattle were $15,000. You also spent $1,500 on gasoline for your machinery around the farm. Your depreciation has been calculated at $5,200 this year. You did not sell any of your machinery this year. You are married and have three children. You have calculated deductions for a business trip you took to Houston for a livestock show at $700. You belong to several young farmer organizations and breeding associations; dues and membership fees come to $100. You calculated you spent $300 on small hand tools with a useful life of less than one year. You also bought a new tractor this year for $15,000 and it is calculated to have a useful life of 10 years. This tractor is eligible for investment credit.

Use the methods discussed earlier in this unit to calculate your estimated income tax on the following page.

Ag IV - VII -122

FARMER FINANCIAL STATEMENT

NAME____________________ ____________________19____

BUSINESS____________________ADDRESS____________________

SS. No.____________________

FOR THE PURPOSE OF OBTAINING ADVANCES FROM TIME TO TIME ON BILLS, NOTES, AND OTHER COMMERCIAL PAPER SIGNED OR ENDORSED BY THE UNDERSIGNED, AND OF OBTAINING CREDIT GENERALLY, THE UNDERSIGNED MAKES THE FOLLOWING STATEMENT OF ________FINANCIAL CONDITION AS OF THE CLOSE OF BUSINESS ON THE ______DAY OF ____________19___, AND CERTIFIES TO THE ABOVE NAMED BANK THAT THE INFORMATION HEREINAFTER SET FORTH IS IN ALL RESPECTS TRUE AND ACCURATE AND COMPLETE AND CORRECTLY REFLECTS THE FINANCIAL CONDITION OF THE UNDERSIGNED ON THE DATE AFOREMENTIONED.

(FILL IN ALL BLANKS, WRITING "NO" OR "NONE" WHERE NECESSARY TO COMPLETE INFORMATION)

ASSETS				LIABILITIES			
CASH ON HAND AND IN BANKS	$			NOTES PAYABLE TO BANK-SECURED	$		
NOTES RECEIVABLE SECURED				-UNSECURED			
NOTES RECEIVABLE UNSECURED				NOTES PAYABLE TO OTHERS			
ACCOUNTS RECEIVABLE				CHATTEL MORTGAGES			
GOVERNMENT SECURITIES				ON LIVESTOCK			
OTHER STOCKS AND BONDS*							
LIVESTOCK*				ON MACHINERY			
FARM PRODUCTS ON HAND*							
CASH VALUE OF LIFE INSURANCE				CROP MORTGAGES			
OTHER CURRENT ASSETS				COVERING________ACRES			
				DELINQUENT INTEREST			
TOTAL CURRENT ASSETS	$			DELINQUENT REAL ESTATE TAXES			
FARM LAND*				DELINQUENT PERSONAL TAXES			
ACRES IN________CO. @	$			CASH RENT DUE			
CITY REAL ESTATE*				LOANS ON LIFE INSURANCE			
FARM MACHINERY, AUTOS, TRUCKS				OTHER CURRENT LIABILITIES			
TRACTORS, AND OTHER EQUIP.*				TOTAL CURRENT LIABILITIES	$		
STOCKS AND BONDS (GIVE				MORTGAGES ON REAL ESTATE			
DESCRIPTION AND VALUES)				MORTGAGES ON CITY PROPERTY			
				TO			
				ALL OTHER DEBTS (ITEMIZE)			
OTHER ASSETS							
				TOTAL LIABILITIES			
				NET WORTH			
TOTAL	$			TOTAL	$		
I HAVE ENDORSED NOTES FOR OTHERS	$			I AM BONDSMAN FOR OTHERS	$		

LIVESTOCK

____HORSES____	@ $ ____	PER HEAD	$			____CALVES____	@ $ ____	PER HEAD	$
____MULES____	@ $ ____	PER HEAD				____SOWS____	@ $ ____	PER HEAD	
____COLTS____	@ $ ____	PER HEAD				____PIGS____	@ $ ____	PER HEAD	
____COWS, STOCK____	@ $ ____	PER HEAD				____STOCK HOGS____	@ $ ____	PER HEAD	
____COWS, DAIRY____	@ $ ____	PER HEAD				____SHEEP____	@ $ ____	PER HEAD	
____STEERS____	@ $ ____	PER HEAD				____EWES____	@ $ ____	PER HEAD	
____HEIFERS____	@ $ ____	PER HEAD				____LAMBS____	@ $ ____	PER HEAD	
____BULLS____	@ $ ____	PER HEAD							
____FEEDERS____	@ $ ____	PER HEAD						TOTAL	$

GRAIN AND FARM PRODUCTS

ON HAND			GROWING CROPS	CONDITION	
________	@ $ ________	$	________		$
________	@ $ ________		________		
________	@ $ ________		________		
________	@ $ ________		________		
________	@ $ ________		________		
________	@ $ ________		________		
________	@ $ ________		________		
________	@ $ ________		________		
	TOTAL	$		TOTAL	$

* SEE SCHEDULE

Ag IV - VII - 123

BE SURE TO INCLUDE EVERY ITEM UNDER EACH SCHEDULF

FARM MACHINERY, AUTOS, TRUCKS, TRACTORS, AND OTHER EQUIPMENT

UNITS	TYPE OF EQUIPMENT	MAKE	AGE	CONDITION	MARKET VALUE	ENCUMBRANCES (IF ANY)

IN WHOSE NAME IS TITLE TO REAL ESTATE RECORDED?

IS REAL ESTATE HELD IN FEE SIMPLE OR LEASEHOLD?

TAXES PAID TO ______ 19___ MORTGAGE INTEREST PAID TO ______ 19___

LAND UNDER LEASE ______ ACRES OF ______ LAND. THE RENTAL PRICE BEING $ ______

WHICH HAS BEEN PAID TO ______ 19____.

REAL ESTATE

DESCRIPTION	ACRES	LOCATION	NATURE OF IMPROVEMENTS	VALUE		MORTGAGES	EQUITY
				ASSESSED	CASH		
			TOTAL	$	$	$	$

HAVE YOU ANY PARTNERS IN YOUR BUSINESS? ______ IF SO, STATE PARTICULARS ______

HAVE YOU EVER BEED ADJUDGED A BANKRUPT? ______ IF SO, STATE PARTICULARS ______

JUDGMENTS ON SUITS PENDING AGAINST YOU AT THIS TIME $ ______

NAMES OF PEOPLE WITH WHOM YOU HAVE BUSINESS RELATIONS AND WHO ARE ACQUAINTED WITH YOUR PERSONAL AND FINANCIAL CONDITION ______

LIFE INSURANCE $ ______ PAYABLE TO ______

BUILDINGS INSURED FOR $ ______ GRAIN INSURED FOR $ ______ CATTLE & HOGS INSURED FOR $ ______

OTHER INSURANCE (ITEMIZE) ______

POST OFFICE ADDRESS ______

(TOWN) (COUNTY) (STATE)

I HAVE RESIDED AT ABOVE LOCATION ______ YEARS ______ MONTHS. FORMERLY RESIDED ______

PROCEEDS OF LOAN MADE BY YOUR BANK ARE TO BE USED (OR HAVE BEEN USED) BY ME FOR ______

(STATE PURPOSE)

I EXPECT TO RETIRE THIS INDEBTEDNESS FROM ______ BY ______ 19______

(STATE SOURCE)

IN SUBMITTIMG THE FOREGOING STATEMENT THE UNDERSIGNED GUARANTEES ITS ACCURACY WITH THE INTENT THAT IT BE RELIED UPON BY THE AFORESAID BANK IN EXTENDING CREDIT TO THE UNDERSIGNED AND WARRANTS THAT ______ HAS NOT KNOWINGLY WITHHELD ANY INFORMATION THAT MIGHT AFFECT ______ CREDIT RISK: AND THE UNDERSIGNED EXPRESSELY AGREES TO NOTIFY IMMEDIATELY SAID BANK IN WRITING OF ANY MATERIAL CHANGE IN ______ FINANCIAL CONDITION WHETHER APPLICATION FOR FURTHER CREDIT IS MADE OR NOT AND IN THE ABSENSE OF SUCH WRITTEN NOTICE IT IS EXPRESSELY AGREED THAT SAID BANK IN GRANTING NEW OR CONTINUING CREDIT MAY RELY ON THIS STATEMENT AS HAVING THE SAME FORCE AND EFFECT AS IF DELIVERED UPON THE DATE ADDITIONAL CREDIT IS REQUESTED OR EXISTING CREDIT EXTENDED OR CONTINUED.

SIGNED AT ______

THIS ______ DAY OF ______ 19___ SIGNATURE ______

Income Tax Worksheet

I. Cooperator's Name ______________________________ SS# _______________

II. Spouse's Name ______________________________ SS# _______________

III. Exemptions:

IV. FARM INCOME AND EXPENSES

A. Income

1. Sales of Purchased Items

	Description	Amt. of Sale	Cost	Profit/Loss
1.	Cattle	$ __________	$ __________	$ __________
2.	Hogs	__________	__________	__________
3.		__________	__________	__________
4.		__________	__________	__________

*TOTAL PROFIT OR LOSS

2. Sales of Raised Items

	Kind	Amount		Kind	Amount
1.	Cattle	$ __________	6.		$ __________
2.	Calves	__________	7.		__________
3.	Sheep	__________	8.		__________
4.	Swine	__________	9.		__________
5.		__________	10.		__________

*TOTAL RAISED SALES

3. Other Farm Income

	Kind	Amount		Kind	Amount
1.	Machine Work	$ __________	5.	CCC Loans under Election (or Forfeited)	$ __________
2.	Patronage Divd.	__________	6.	Fed. Gasoline Tax Refund	__________
3.	Non-Patronage	__________	7.	State Gasoline Refund	__________
4.	Ag. Prog. Pmts. a. Cash b. Materials & Services	 __________ __________	8.	Other	__________
			9.		__________
			10.		__________

*TOTAL OTHER

GROSS PROFITS

B. Expenses

	Kind	Amount		Kind	Amount
1.	Hired Labor	$	12.	Gas, oil, fuel	$
2.	Repairs, maint.		13.	Storage	
3.	Interest		14.	Taxes	
4.	Rent of farm, pasture		15.	Insurance	
5.	Feed Purchased		16.	Utilities	
6.	Seeds, plants, purchased		17.	Freight, Trucking	
7.	Fert., lime, chemicals		18.	Conserv. Expenses	
8.	Machine Hire		19.	Land	
9.	Supplies Purchased		20.	Benefit Plans	
10.	Breeding Fees		21.		
11.	Vet Medicine		22.		
			23.		

TOTAL CASH EXPENSES

C. Depreciation Schedule

1. Items Purchased

a. Date b. Description c. Total Purchased Price

2. Items Traded

a. Date b. New Item c. Old Item d. Total Boot Paid

3. Items Sold

a. Date b. Description c. Total Sale Price

4. Sale of Livesotck that Qualify for Capital Gain

V. NON-FARM INCOME

1. Wages (W-2 Forms)

   a. Gross Wages ____________
   b. Federal W/H ____________
   c. State W/H ____________
   d. FICA W/H ____________

2. Interest Income

a. Source	b. Amount
1.	____________
2.	____________
3.	____________

3. Dividend Income

a. Source	b. Amount
1.	____________
2.	____________
3.	____________

4. State and Local Income Tax Refunds ____________________________

5. Alimony Received ____

6. Pension and Annuity Income ______________________________________

7. Rent and Royalty Income

	a. Kind	b. Total Amount	c. Depreciation or Depletion	d. Other Expenses
1.				
2.				
3.				
4.				

8. Other Income

	a. Kind	b. Amount		a. Kind	b. Amount
1.			3.		
2.			4.		

VI. ADJUSTMENTS TO INCOME

(Moving expenses, employee business expenses, payments to IRA or Keogh, interest penalty, alimony paid.)

1. 3.
2. 4.

II. ITEMIZED DEDUCTIONS (PERSONAL)

1. Medical and Dental Expense
   - a. Insurance Premiums ____________
   - b. Medicine and Drugs ____________
   - c. Doctors, nurses, dentists, etc. ____________
   - d. Hospitals ____________
   - e. Other ______________
   - f. _____________________

2. Taxes
   - a. State and local income _________
   - b. Real Estate _____________________
   - c. State & Local Gasoline _________
   - d. General Sales _________
   - e. Personal Property _________
   - f. Other ___________

3. Interest
   - a. Home Mortgage ____________
   - b. Credit and charge cards __________
   - c. Other ____________
   - d. ______________

4. Contributions
   - a. Cash contributions w/written evidence ___________
   - b. Other (list)

5. Casualty or Theft Loss (explanation)

6. Misc. Deductions
   - a. Union dues _________
   - b. Other __________

VIII. CREDITS - WILL I QUALIFY FOR

a. Contributions to Candidates for Public Office _________
b. Child and Dependent Care ____________
c. Residential Energy _____________
d. Federal Fuel Tax Credit: Type of Use _____Fuel_____Gallons
   1. Farming
   2.

e. Other ____________

IX. OTHER INFORMATION

Income Tax Estimate Worksheet

RECEIPTS: ESTIMATED AMOUNTS

Sales of products raised* and miscellaneous receipts:

Cattle, hogs, sheep and wool, etc..............$ ______

Poultry, eggs and dairy products..............$ ______

All crops sales ....$ ______

Custom work, prorations and refunds agriculture program payments...............$ ______

Total sales and other farm income.............(1) $ ______

Sales of purchased market livestock+............$ ______

Purchase cost (subtract)++......................$ ______

Gross profits on sales of purchased livestock+(2) $ ______

Gross farm profits (Item 1 + 2)...............(3) $ ______

FARM EXPENSES:

Labor hired..........	$____	Vet. Med..............	$______
Repairs, maintenance	____	Gas, fuel, oil........	$______
Interest............	____	Storage, warehousing..	______
Rent of farm, pasture	____	Taxes.................	______
Feed purchased.......	____	Insurance.............	______
Seed, plants purch...	____	Utilities.............	______
Fert, lime........ ..	____	Freight, trucking.....	______
Machine hire.........	____	Conserv. expenses.....	______
Supplies purch.......	____	Other Business, fees..	______
Breeding fees........	____	Other.................	______

Total cash farm expenses.......................(4) $ ______

Depreciation on machinery improvements, dairy and breeding stock...........................(5) $ ______

Total deductions (Item 4 + 5).................(6) $ ______

Self employ. farm income(Item 3 less item 6)++(7) $ ______

Net taxable gain from Schedule D (Sales of dairy and breeding stock, mach. & other capital exchanges).......(8) $ ______

Taxable non-farm income.......................(9) $ ______

Adjusted gross income (Item 7 + 8 + 9).......(10) $ ______

Less $_____: Excess itemized deductions**

($1,000 x _____ personal exemptions)***......

Total non-business deductions and exemptions (11) $ ______

Taxable income (Item 10 less item 11)........(12) $ ______

Estimated income tax (calculated from applicable sales tax computation table or rates).....(13) $ ______

Est. self-employ. tax(Item 7 x current rate).(14) $ ______

TOTAL TAX (Item 13 + 14)....................(15) $ ______

Less Credits: allowable investment credit and carry-over, gas tax, income tax withheld and estimated tax paid.................................(16) $ ______

Estimated tax due (Item 15 less item 16).....(17) $ ______

ESTIMATED STATE INCOME TAX DUE...............(18) $ ______

---

* For accrual method include sales of all livestock.

** Use itemized deductions if larger.

*** Exemptions for 1979, see current tax regulations for subsequent years.

+ Omit for accrual method.

++ For accrual method adjust for change in inventory and new livestock purchases.

Courtesy of and adapted from Income Tax Management for Farmers. Southern Farm Management Extension Publication No. 17. Cooperative Extension Service. University of Georgia College of Agriculture.

Income Tax Worksheet

I. Cooperator's Name ______________________________ SS# ______________

II. Spouse's Name ______________________________ SS# ______________

III. Exemptions:

IV. FARM INCOME AND EXPENSES

A. Income

1. Sales of Purchased Items

	Description	Amt. of Sale	Cost	Profit/Loss
1.	Cattle	$	$	$
2.	Hogs			
3.				
4.				

*TOTAL PROFIT OR LOSS

2. Sales of Raised Items

	Kind	Amount		Kind	Amount
1.	Cattle	$	6.		$
2.	Calves		7.		
3.	Sheep		8.		
4.	Swine		9.		
5.			10.		

*TOTAL RAISED SALES

3. Other Farm Income

	Kind	Amount		Kind	Amount
1.	Machine Work	$	5.	CCC Loans under Election (or Forfeited)	$
2.	Patronage Divd.		6.	Fed. Gasoline Tax Refund	
3.	Non-Patronage		7.	State Gasoline Refund	
4.	Ag. Prog. Pmts.		8.	Other	
	a. Cash		9.		
	b. Materials & Services		10.		

*TOTAL OTHER GROSS PROFITS

Agricultural Marketing

Instructor's Guide:

1. This unit was designed as a supplement to the Farm Business Management Unit.
2. Use this unit if information on marketing is required for wise farm sales in your area.
3. This unit contains more information than probably needed by most programs. Therefore, select the sections most appropriate for your use.
4. Utilize Chicago Board of Trade information as listed under resources as a primary reference.

Objectives:

Upon completion of this unit, the student will be able to:

1. Define marketing.
2. Identify the nine marketing functions.
3. List the steps of marketing development.
4. Describe the theory of demand and the functions that affect demand.
5. Distinguish between complementary and substitute goods.
6. Describe the marketing margin.
7. Describe the functions that affect supply.
8. Understand the use of the futures market.
9. List and describe the four types of competition.
10. Identify the problems with ag transportation.
11. Describe the advantages and disadvantages of the three modes of transportation in Oregon.
12. Explain the purpose of grades and standards.
13. Describe the purpose and functions of Coop's.
14. Describe International Trade.
15. List three types of government protection to insure fair trade of exports.

Teaching Aids:

1. Sperry New Holland: transparency masters and discussion on the Futures Market.
2. Selling in Agribusiness: Miller and Lee; McGraw-Hill Book Co.
3. The Wall Street Journal and/or The Capital Press.
4. Agriculture Management Series: Vocational Education Productions - Ag Marketing sound filmstrip $32.50 - California Polytechnic State University, San Luis Obispo, California 93407.
5. Chicago Board of Trade Future's Market slides (see resources).

Student Activities:

1. Develop a futures market within the classroom. Utilize three to four different commodities, the Wall Street Journal or Capital Press. A simple form of record keeping for buying, selling, profit and loss, and graph paper for charting the price flow. Conduct this activity during the entire Ag Marketing Unit.

References:

1. Chicago Board of Trade
   Future's Market Slides and Instructional Material
   Educational Services
   LaSalle at Jackson
   Chicago, IL 60604

   Instructors Manual $4.50
   Workbooks $25/pkg. 30
   Chapter tests $1/pkg.

2. Market and Price Analysis: Dahl and Hammond; McGraw-Hill Book Co.
3. Selling in Agribusiness: Miller and Lee; McGraw-Hill Book Co.
4. Doan's Farm Management Guide: Doan's Manufacturing
   8900 Manchester Rd.
   St. Louis, MO 63144
5. Modern Agriculture Management: Osburn and Schneeberger
6. Weekly Marketing Newsletters (i.e., Oregon Wheat League).

Introduction Ideas:

1. Guest Speaker: A local farmer or Cooperative representative that has been successful in Ag Marketing, or understands the factors of Ag Marketing.

2. Ag Marketing sound filmstrip: (refer to Teaching Aids).

Agriculture Marketing

I. Marketing

   A. Definition.

      1. A location where at specific times suppliers come together with consumers for exchange of various commodities.

   B. Purpose of a market.

      1. Sets a price.

      2. Provides information for future planning.

      3. Subsequently allocates resources.

   C. Market Functions.

      1. Exchange.

         a. buying
         b. selling

      2. Facilitation.

         a. storage
         b. processing
         c. transportation

      3. Financial.

         a. financing
         b. risk bearing
         c. marketing information
         d. standardization of goods

   D. Factors of Ag Marketing.

      1. Perishable products.

      2. Seasonally produced products.

      3. Continuous consumption of products.

      4. Most products consumed in processed form.

      5. Price variability for products.

      6. Products can be produced in one area and consumed in another.

II. The Advancement of Agricultural Marketing.

   A. Self-sufficiency.

      1. A means of survival.

      2. Everything produced was utilized.

      3. No specialization or marketing locations.

   B. Agrarian Organization.

      1. Products produced in excess were exchanged for other needs.

      2. County fair and local store are examples of agrarian organization.

   C. Agricultural Organization.

      1. Surplus products developed through specialization.

      2. Markets developed over larger areas.

      3. Markets became specific.

      4. Ag commodity marketing firms developed.

   D. Commercial Organizations.

      1. Specialist and specialization on all ag commodities.

      2. Producer to the marketing organization to the consumer.

III. Changes in Ag Marketing.

   A. Farming Changes.

      1. Farm numbers have decreased.

      2. Farmer numbers have decreased.

      3. Acreage has increased due to specialization in today's farming.

   B. Market Changes.

      1. Contacts and language are different in today's marketing world.

      2. Government policy is being shaped by other means than just Ag Marketing.

3. Economic policy focuses on international food market.
4. The farm vote has lost its importance.
5. Diversification has caused marketing changes.
6. Consumerism now dominates ag economic policy.

IV. Demand Theory.

A. Definition.

1. The realistically estimated market for a products, supply or service.
2. An agribusiness manager has to be able to estimate the demand or market for products, supplies or services pretty accurately.

B. Terminology used in demand theory.

1. Dumping: consistantly selling below market price to force others out of business.
2. Luxury: consumers are responsive to price change.
3. Necessity: consumers are not responsive to price change.
4. Complementary good: decrease in demand if price goes up.
5. Substitute: produce can be replaced if price goes too high.

C. The Theory.

1. A behavioral relationship that describes how much product will be purchased at different prices under a carefully defined set of conditions.
2. Types of demand.
    a. consumer demand
        1. the purchasing behavior of one or more buyers who will consume the utility of the product
    b. intermediate demand
        1. the price-quantity purchasing behavior of buyers who obtain the product for resale
    c. market demand

1. the total demand of individual buyers at any one market level

D. The Demand Relationship.

1. Expressed as the relationship between price and quantity purchased of:

    a. a well-defined product
    b. at or during a particular time
    c. at a particular place or over a specific geographical area

2. Assumed constant factors.

    a. consumer disposable income
    b. prices of substitute products
    c. prices of complementary products
    d. expectations of future prices
    e. tastes and preferences

$Qd = f(P \mid Y, Ps, Pc, E, T)$ where Qd = quantity demand
f = function
P = price
| = holding following variables constant
Y = income
Ps = prices of substitutes
Pc = prices of complements

V. Supply Theory.

A. Definition.

1. The condition that exists with respect to any good whenever the quantity demanded at the prevailing price is less than the quantity available.

B. The Theory.

1. Market supply relationships for agriculture are relationships in which the quantities that will be offered at the alternative prices with all other factors affecting supply held constant.

2. Factors considered:

    a. prices of inputs
    b. prices of other products that can be produced with the same resources
    c. technology
    d. the number of firms

C. The Supply Relationship.

$Qs = f(P, Pi, Po, Te, N, E, C)$ Where

Qs = quantity supplied
f - function
P = price of commodity
Pi = price of inputs
Po = price of other possible outputs
Te = technology
N = number of firms
E = expectations
C = capacity of plant (number of acres)

VI. Marketing Margin.

A. Definition.

1. The difference between prices at different levels of the marketing system.
2. The difference between farm price and retail price.
3. Refers only to the price difference and makes no statement about the quantity of product marketed.
4. Food cost - farm price = marketing margin.

B Why marketing margins have gone up:

1. Labor.
2. Energy price.

VII. Futures Market.

A. Definition.

1. A pricing tool to allow farmers to produce for a price.
2. Organized form of trading of futures contracts of agricultural commodities.
3. A futures contract is an agreement that is made subject to the rules of an organized exchange to buy or sell a stipulated amount of some commodity at a fixed price for delivery at a future date.

B. Purpose of Futures Market.

1. Divert Risk.
    a. speculator: in it for the money (get rich quick idea)
    b. hedger: has physical charge of the commodity and hedges against the risk of loss due to a price change

1. short hedger: sells in advance
2. long hedger: buys in advance

2. An organized facility and institution in which buyers and sellers engage in transaction for future contracts.

C. The Contract.

1. The future contracts are promises to deliver specified products at some future time.

2. The contracts are traded for both hedging and speculating purposes.

3. A selling hedge is made by a person who wishes to avoid the possiblity of price change and is accordingly willing to sell a delivery at some time in the future of the product that the person holds.

    a. futures and cash prices move together
    b. a sale of a futures contract followed by a repurchase of contract at a later date will generally minimize a loss due to price change

4. Speculators wish to assume price risk in hopes of making financial gain through the purchase and sale of future contracts.

    a. speculators assume the price risk
    b. hedgers avoid the price risk

D. The Steps to Hedging:

1. Around planting or planning time check into future market prices.

2. Calculate cost of production.

3. Localize the futures price - know the basis which is the difference between future market price at a particular time and the cash market price at a particular time and place.

4. Make the hedging decision.

5. See the broker and lender.

6. Place the hedge.

7. Watch the market.

8. Lift the hedge.

9. Determine the results.

VIII. Market Structure.

- A. Perfect Competition.
    1. Exists where there are a large number of firms.
    2. One firm cannot affect the market.
    3. Each firm has equal knowledge of information.
    4. Each firm has equal technology.
    5. Low barriers for entry and exit.
    6. A price taker, not a price setter.
    7. In the long run, they will never have economical profit.
    8. Market conducts itself.
- B. Monopolistic Competition.
    1. Low barriers to entry.
    2. Sub markets.
    3. A lot of producers.
    4. Same product, but strive for a different market.
    5. Capture a small part of the market for own commodity.
- C. Olagopoly.
    1. Few firms produce all outputs.
    2. Higher fixed cost.
    3. Difficult entry level.
    4. Three or four firms dominate the market.
- D. Pure Monopoly.
    1. Only one product - no substitutes.
    2. Limited entry level.
    3. High fixed costs.
    4. Price discrimination.
    5. Firm sets prices.
    6. Long term misallocation of resources.

IX. Transportation.

A. Reasons for transportation for agricultural products:

1. Oregon covers a large geographic area.

2. Regional specialization of agricultural products in Oregon.

B. Problems with transportation:

1. People view transportation as an utility and transportation should always be there.

2. Transportation competes for private capital and facilities.

   a. use of highways
   b. farm land consumption due to increased construction of highways for trucking
   c. very energy intense
   d. very labor intense

C. Transportation problems unique to agriculture:

1. Parishable products.

2. Products seasonally produced.

   a. must charge more
   b. higher fixed costs

3. Specialized equipment.

   a. refrigeration box cars
   b. loading and unloading equipment

4. Products are transported into plant in one form, are processed and then transported out in another form, thus requiring two different types of transportation.

5. Competes with other public systems or facilities.

D. Transportation effect on plant location.

1. Economic considerations:

   a. if there is a factor of shrinkage in product while processing, then the plant is close to the producer
   b. if product is of high value, then it is usually processed some distance from the producer
   c. labor cost
   d. tax cost
   e. transportation

X. Transportation in Oregon.

A. Truck.

1. Most dynamic.
2. Variable fix cost.
3. Fluid market.
4. Cost of service.
5. More competition.

B. Rail.

1. One-quarter of the energy consumed in rail transportation as compared to truck transportation.
2. High fixed cost.
3. High value, high rate.
4. Sensitive to demand.
5. Owns roadbed and maintenance.

C. Barge.

1. One-third of energy consumed in barge transportation as compared to trade transportation.
2. Low value, high bulk.
3. Non-perishable goods (56 to 58 percent grain).
4. Variable cost.
5. Fixed routes.

XI. Pacific Northwest Transportation.

A. Advantages.

1. Newer rail and highway built east to west.
2. The Columbia River.
3. Three district modes of transportation:
    a. rail
    b. barge
    c. truck

B. Problems.

1. Rail system restoration.

2. Highway breakup.

3. Bonneville locks.

4. Port capacity.

5. Shifting markets.

XII. Grades and Standards.

A. Definition.

1. Unit of trade.

2. Standard weight is how much you are getting.

3. Grade is the quality of product.

B. Objective of grades and standards.

1. To improve marketing efficiency.

a. speeds up transitions
b. improves sales volume
c. encourages specialization
d. enlarges marketing area
e. reduces advertising
f. increases competition
g. may innovate new technology
h. price quotes are more precise
i. systematically allocates supplies
j. allows for marketing information collection
k. closes market margins

XIII. Agribusiness.

A. Where products are shipped.

1. Private business for profit.

2. Federally organized.

3. Coop's.

B. Coop's.

1. Marketing Coop's.

a. sell products

2. Supply Coop's.

    a. supplies inputs for production such as fertilizer, seed
    b. buys wholesale finished products
    c. sells retail at a lower price

3. Credit union.

    a. lower loan rates
    b. higher return interest

4. What governs a coop?

    a. democratic control
    b. open entry
    c. return is fixed and will be divided between participants
    d. only in cash
    e. standard of goods
    f. political and religious neutrality
    g. provides incentives

        1. tax
        2. lower loan
        3. maximum profit

XIV. International Trade.

A. Why use the international market?

1. Increases specialization.

2. Increases output.

3. Tends to equalize prices.

4. Increases world income.

5. Economic advantage.

6. Bilateral Trade Model.

    a. export raises producer price
    b. lowers consumers price

7. Minimize spot shortages of food.

8. Trade develops diplomatic ties.

B. International Trade Protection.

1. Purpose.

    a. created to stop international trade to protect the domestic market

2. Trade protections.
    a. infant industry
        1. once on its feet then it will have a comparative advantage over import competition
    b. national security
        1. industry vital to U.S. in case of war
    c. national health and well being
    d. protecting domestic programs
    e. unfair trade practices such as tariffs
    f. slow the pain of adjusting to different economy

C. Type of trade barriers to ensure fair trade of exports:

1. Tariffs.
    a. fixed tax on imports
    b. percent of amount of value
    c. increase price
    d. increase government income
2. Non-tariff.
    a. quotas
3. Variable levy.
    a. floating tariff
    b. used to subsidize agriculture

Ideal Farm Project

Instructor's Guide:

1. This unit was developed for advanced Vocational Agriculture students with several years of instruction in agriculture principles.
2. The purpose of this unit is to allow the student to show the knowledge they have accumulated, as well as indicate their ability to research different agriculture references.
3. The final draft should be typewritten or neatly written in ink, as well as presented in a neat and attractive manner.
4. Spelling and grammar should be graded. Students should use a dictionary.
5. Total points possible for this project is up to individual instructors. (100 points has been the recommended total points.)

Objectives:

Upon completion of this unit, the student will be able to:

1. Design a realistic farming operation based upon previous years of Vocational Agriculture instruction and indicating reasonable possibilities of financial success.

References:

1. References for this unit will be the following previously instructed units; a) Animal Science, b) Crops Science, c) Soils, d) Farm Business Management, e) Ag Marketing, and f) Agricultural Machinery.

Ideal Farm Project

I. General Information for Project Design

  A. Type of Operation.

    1. Matter of individual opinion.

    2. Designed according to personal tastes.

  B. A realistic representation of today's agriculture.

  C. Must show a reasonable possiblity of financial success.

  D. Describe the farm as if it existed today - completely operational.

II. The Seven Sections of the Ideal Farm Project

  A. Section 1: General Overview of the Farm.

    1. The actual geographical location of the farm.

    2. The acreage and topography of the farm (include soil series).

    3. The type of farming enterprises present (types of crops and/or livestock farmed).

    4. The total monetary value of the farm.

  B. Section 2: Inventories.

    1. Include a detailed machinery inventory (include brands and model numbers).

    2. Include livestock (types, breeds, and ages).

    3. Include building inventory.

    4. The dollar values, as well as a list of the items, should be included.

  C. Section 3: "How To Guides."

    1. Create a discussion of management practices for each type of crop or livestock produced (fertilizer and spray schedules, etc.).

  D. Section 4: Annual Operating Budget.

    1. Include an itemized list of income and expenses for each enterprise.

E. Section 5: Market Report.

   1. Explain where and how the different products produced would be marketed.

F. Section 6: Maps.

   1. Make detailed drawings of the farm layout and facilities.

   2. Label everything.

   3. Keep it neat.

G. Section 7: Summary.

   1. Compile a quality summary of the project.

   2. Must contain reasoning for choosing selected farm.

   3. Determine if the farm would be economically profitable.

   4. Any conclusions drawn about this type of farming operation from research.

Projects, Conclusion

Instructor's Guide:

1. Use Projects, Conclusion unit to motivate students to complete projects as started during Projects, Initiation.
2. All projects should be completed during this unit since time was provided for students to secure needed materials and parts, as well as improve attitude towards project.
3. Small Gas Engine completion may also be utilized during this period of time.
4. Maintain shop safety standards during project construction.
5. Keep all students busy or go on to another unit.

Computers and Agriculture

Instructor's Guide:

1. Read objectives and entire unit prior to purchasing any equipment or instruction.
2. Visit local farms or agribusinesses to gather additional information prior to unit instruction.
3. Locate all necessary equipment and materials listed under teaching aids and references prior to unit instruction.
4. Practice on the computer prior to unit instruction.
5. Make arrangements for guest speaker presentation-demonstration (refer to reference #2).

Objectives:

Upon completion of this unit the student will be able to:

1. Identify and define terms associated with computers.
2. Establish a general working knowledge of the computer world.
3. Understand the future of computers on the farm.
4. Understand the "software and hardware" in computer operation.
5. Understand and apply computer applications-Visicalc.

Teaching Aids:

1. Apple II or Apple II Plus (with at least 48K memory).
2. Apple Disk II Disk Drive.
3. Some blank 5¼" diskettes.
4. The Visicalc program diskette.
5. A TV set or other video monitor.
6. Optional: The Apple Language System to increase memory by 16K.
7. Agriware Agricultural Software directory for Apple Computer (refer to references for address).
8. The AppleSoft Tutorial Book (refer to references for address).

9. The DOE Manual (refer to references for address).
10. Cdex Training for Visicalc (refer to references for address).
11. Ag Disk-Affordable Software with advanced features (refer to references for address).

Student Activities:

1. Learn terms and definitions related to computers.
2. Understand the objectives of this unit.
3. Visit any local farms as well as agribusinesses to see computers and their use in agriculture.
4. Guest speaker presentation-demonstration.
5. Utilize the computer in running programs for SOEP Record Books.
6. Compute various programs as established by the instructor.
7. Develop a section in Vo-Ag notebook for computer unit.

References:

1. Ed Schmisseur
Extension Hall 227
Oregon State University
Corvallis, Oregon 97331
(503) 754-2942

2. Mrs. Reta Leabo
Mrs. Betty Evans
Farmplan Record Keeping Systems
33955 Hwy. 99E
Tangent, Oregon 97389
(503) 926-8427
*available for presentations
and demonstrations

3. Agri Comp
The Reference for Farm Computing
103 Outdoor Building
Columbia, Missouri 65201

4. AgriWare
Agricultural Software Directory for Apple Computer
Farmplan Record Keeping Systems
33955 Hwy. 99E
Tangent, Oregon 97389

5. The Applesoft Tutorial Book (Apple produce #A2L0018(030-0044-C))
   The DOS Manual Apple II (Apple produce #A2L0036(030-0115-B))
   10260 Bandly Drive
   Cupertino, California 95014
   (408) 996-1010

6. Cdex Training for Visicalc
   Cdex Corporation
   5050 El Camino Real
   Suite 200
   Los Altos, California 94022
   cost - $49.95

7. Ag Disk-Affordable
   Software with Advanced Features
   California Polytechnic
   San Luis Obispo, California 93407
   cost - complete package - $600
   manual only - $29.95

Table of Appendices:

1. Appendix A: Shopping for an on-farm Computer
   Buying the Farm's Computer

2. Appendix B: Ag Disks: Visicalc Templates
   Financial Management
   Farm Accounting
   Market Charting
   Machinery Management
   (available through Farm Plan Record Keeping Systems)

3. Appendix C: Single vs. Double Entry Debate

4. Appendix D: Farm Ledger: An Accounting Alternative

5. Appendix E: Farm Filer-File Planning Forms

6. Appendix F: Visicalc Programming

Computer Terms and Definitions:

1. Applications: The various practical uses of computer software to achieve completion of a task.

2. Bytes: (pronounced bites) A character of information stored in a computer. A piece of hardware with 64K storage means 64,000 characters or bytes of data can be stored in the computer.

3. Chip: A very tiny silver of silicon, several of which contain the sophisticated electronic circuitry found in computers. The microchip is the single most important advancement made, allowing manufacturers to produce extremely powerful computers in table-top sizes.

4. Cassette: A small reel of magnetic tape used by some systems for storage of data.

5. CRT: (Cathode Ray Tube) The TV-like monitor on which program information is displayed.

6. Disk/Diskette: (Also known as a floppy disk) A square sheet of flexible material resembling a small phonographic record. It stores data much like cassette tapes.

7. Documentation: A package of literature that accompanies most software programs. Documentation literature explains the uses for particular programs and instructs the operator in its use.

8. Hardware: The machinery that makes up a computer system.

9. Hard Copy: A printout of data.

10. Keyboard: An input device that resembles a typewriter.

11. Menu: A selection of programming options displayed by the software package.

12. Microprocessor: A miniturized circuit that contains complete computer processing logic.

13. Modem: A device attached between a computer and a phone line that translates the incoming or outgoing message into a form understood by the computer.

14. Password: A code word or group of characters a computer system might require to allow an operator to perform certain functions. A passwork functions as a key-allowing access to the computer files.

15. Peripherals: Add-on accessories that go beyond the computer system unit. Examples of these devices include disk drives, tape drives, display monitors and printers.

16. Printer: A device that types out the information contained in storage. A printer gives you a hard copy of the data.

17. Program: A set of computer routines used to solve a problem. The instructions are executed in the order they are written.

18. RAM: (Random Access Memory) The portion of computer memory generally available to execute programs and store data.

19. ROM: (Read Only Memory) A portion of computer memory where information is permanently stored. This information can be read, but can never be altered.

20. Run: Execute a program.

21. Software: A package of programs. Software is simply the instructions that are given to the hardware.

22. Sort: Arranging records in order.

23. User: The person or persons who operate a computer.

24. User Friendly: A hardware and software computer system that has been designed with the user in mind. This type of system is extremely easy to use by beginners.

Computers and Agriculture

I. The Need and Use of Computers in the Field of Agriculture.

  A. The present and future of computers.

    1. Computers affect each and every one of us.

      a. In our jobs
      b. In our daily lives

    2. Computers are not new, but the computer world is changing very rapidly.

      a. Changes are making computers more affordable
      b. Encouraging a new look at some applications and new ways in which computers can be used

    3. The Computer.

      a. An electronic device that computes and stores data
      b. Performs complex calculations
      c. Hardware

        1. The actual physical components of the machine
        2. The things you see and touch

      d. Software

        1. Set of instructions that tells the computer how to solve the problem (known as the operating systems)
        2. The instructions that tell a computer how to keep track of its many components
        3. Without software the computer is nearly useless

  B. The Computer Components.

    1. When buying or evaluating a computer, look at it having four major components:

      a. Input device

        1. The way to get numbers/information into the computer

      b. Central Processing Unit

        1. The device which does the calculating

      c. Unit for information displayed or printed

        1. A printer
        2. A video monitor

    d. Device where data can be stored

        1. Central processor has some storage capacity
        2. Central processor is not large enough for many programs or storing large volumes of data
        3. Central processor looses the data when the power is turned off
        4. Typically data is stored on disk or tape

C. Types of Hardware.

1. Four different types of computers broken down by size:

    a. Large main frame computers

        1. Accessed through batch processing
        2. Accessed through remote terminals

    b. Minicomputers
    c. Microcomputers
    d. Programmable calculators

2. Batch Processing.

    a. One way of using a large computer
    b. Information is punched out on computer cards using key punch machine
    c. Punched cards are put in proper order
    d. Punched cards are then taken to a card reader
    e. Punched cards go from card reader to computer
    f. Central processor does calculations called for by the computer program
    g. Results are printed
    h. Results are stored and distributed
    i. Time consuming operation

3. Time-Sharing.

    a. Can decrease the turn-around-time
    b. Microcomputer or acoustic coupler equipped with special accessories can be connected to mainframe computer
    c. The acoustic coupler and special accessories translate electronic signals created by the terminal or computer into audible tones
    d. Audible tones can be transmitted over normal telephone lines to a large computer, processed and results sent back immediately
    e. There are many agricultural time-sharing systems throughout the United States

1. AGNET (Agricultural Computer Network)
    a. Mainframe in Lincoln, Nebraska
    b. Six states are partners in AGNET (Nebraska, North and South Dakota, Montana, Wyoming and Washington)
    c. Do not have to be partner to use it
    d. Many easy-to-use Ag Programs on AGNET

4. Minicomputers and Microcomputers (difficult to tell the difference).
    a. Interest is growing all the time with microcomputers in Agriculture
    b. Practical system for most farms and ranches
        1. 48K of memory
        2. Two disk drives
        3. A printer
        4. A video monitor
        5. Software

5. Programmable Calculator.
    a. Contains a micro-processor (a very small computer)
    b. Best used for recurring type of problem where few numbers are punched in to obtain a couple of answers
    c. Limited to input, output or large quantities of data stored

D. How the Computer works internally.

1. Binary System.
    a. The use of the letters of the alphabet, numbers and symbols within the computer
    b. There are only two digits in the binary system
        1. 0
        2. 1
    c. Example of how 0 and 1 maintain all the letters, numbers, and symbols
        1. Most home computers have a 8 bit processor
        2. Eight light bulbs represent the 8 bit processor
        3. Each individual light bulb is called a "bit"
        4. The eight light bulbs together are called a "byte"
        5. Each light bulb can be turned on or off
        6. Each combination of on/off bulbs represents one letter, number or symbol
        7. One thousand bytes is called a Kilobyte-"K"

  - a. Term to measure computer capacity
  - b. 48K, 64K, 32K, 16K, 128K computers
  - c. 48K holds in memory a maximum of 48,000 individual numbers, letters or symbols at one time
  - d. Disks are used to store information so 48,000 individual numbers, letters and symbols are always available

E. Computer Application.

1. What to Computerize.

   a. Those items that have the greatest payoff

      1. Clerical jobs (jobs that are done by hand)
      2. Jobs that take a lot of figuring
      3. Frequent computations
      4. Jobs where there is a great deal of information to keep track of

   b. A program

      1. All jobs for the computer requires a program
      2. A set of directions that tell the computer how to solve a problem

2. The four types of Computer Application:

   a. Analysis

      1. Problem solving type
      2. Put in numbers and get results

   b. Information retrieval

      1. Involves retrieving information from a computer data bank which is continually updated
      2. Example:

         a. Store all pesticide information on the computer
         b. Tell computer what crop you are growing, state you are in and what pest you have
         c. Computer will search in data files
         d. Respond with chemicals that are currently labeled for controlling that pest

   c. Monitoring

      1. Similar to information retrieval, but with more emphasis placed on processing the information once it's retrieved

2. Example:
    - a. Financial accounting
    - b. Maintaining livestock improvement needs

d. Administrative (office management applications)

1. Used to keep mailing lists
2. To write/revise letters
3. Order supplies

F. Software.

1. Ways to obtain software.
    - a. Using someone elses
        1. Time-sharing
        2. Buying software
    - b. Hiring someone to write the program
    - c. Writing the program yourself
2. Purchased Programs.
    - a. Coded form
        1. Type onto the computer
            - a. Disk
            - b. Cassette tape
    - b. Make sure program does what you want
    - c. Make sure it is easy to use
    - d. Make sure it is designed to work on your computer

G. Other Issues.

1. Obsolescence.
    - a. A state of mind
    - b. If the device you bought still does its job, it is not obsolete
2. Time-Saver
    - a. True in some computer applications
    - b. Will not be a "time-saver" when entering the information
    - c. Once information is in, then it is a time-saver, provided you have the right programs

H. Computerization Decision Process.

1. The approach to use if considering a computer:

   a. List specific applications that you want to be done
   b. Find out if software is already available to do the jobs identified
   c. Consider the costs and benefits of computerization
   d. Make a decision

2. Reminders:

   a. Need to know how to solve the problem
   b. Only use the computer to do the calculations
   c. Understand the problem, the computer can lead to poor solutions
   d. Computers don't make up for poor management
   e. Computers cannot guess at missing or incorrect numbers
   f. In using the computer, more information is needed, not less

II. Computers on the Farm.

A. Facts about today's farmer.

1. Faced with a dismal economy.

2. Real income has plunged to its lowest level since the Great Depression.

3. With the recession the farmer is beginning to seek out the computer industry to help in:

   a. Assisting management decisions
   b. To help maintain records
   c. To possibly help equalize the "little guy's" confrontation with OPEC, the U.S. Government and the middleman into a fair fight

B. The uses of the homecomputer on the farm:

1. Applications.

   a. Enterprise analysis
   b. Double-entry bookkeeping/single-entry system
   c. Least-cost feed programs
   d. Animal health records
   e. Detailed pedigree, health, breeding records

2. The computer.

   a. A microcomputer can pay for itself in a single day if it helps the farmer make the correct decision

b. A farmer can either use a microcomputer or use a terminal
    1. A dumb terminal can be used to access County Extension mainframe computer

c. Software
    1. Beware of software straight off the shelf
        a. It may come close to what the farmer may need, but,
        b. Doesn't exactly meet individual farmers needs
    2. Most agriculture software is an adaptation of existing business/accounting packages
    3. Software distributions haven't developed a lot of agricultural software
    4. Purchase software before hardware!
        a. Information needed may not be available in software
        b. Not enough disk capacity to run

III. Farm Computers: Software and Hardware.

A. Software.
    1. Software is the very first step in purchasing any computer.
    2. A general term used for the programs or list of instructions needed.

B. Hardware.
    1. The computer equipment.
    2. Many ways you can put together hardware systems.
    3. Typical farm computer set-up:
        a. The computer itself (whether built into a TV-like terminal or separate)
        b. A given amount of internal memory capacity
        c. The terminal (usually a video terminal with its TV screen)
        d. One or more disk drives or other means of storing programs and information magnetically
        3. A printer to put information on paper
    4. The brand of equipment is only part of the decision - be sure the computer will run the program needed for given situation.

C. Check list of considerations before purchasing software/hardware.

1. The job you want or need done, but haven't done due to time or difficulty.

2. Determine exactly what you want the computer to do on the farm.

3. Analyze carefully the way the job is presently being done.

4. Gather outside opinions.

5. Visit at least one other farm family utilizing a computer.

6. Locate a retailer or programmer who will give a complete demonstration.

7. Make sure the demonstration meets satisfaction.

8. Recognizing frustration ahead due to working out the bugs with the computer.

9. Possibly consider custom programming.

10. **Don't rush** - haste leads to mistakes.

IV. VisiCalc.

A. Background Information.

1. VisiCalc combines the convenience and familiarity of a pocket calculator with a powerful memory and electronic screen capability of the computer.

2. Ideally suited for problems commonly solved with a calculator, pencil and paper.

3. Budgets, cash flows, income tax, finance ratios and more can be calculated on a VisiCalc program.

4. VisiCalc will let you change, insert, or delete titles, numbers or formulas.

5. VisiCalc will replicate at other positions.

6. VisiCalc will also sum, average or otherwise manipulate rows, columns or other ranges of numbers.

7. Once a particular application format is established, it can be saved on an electronic worksheet on a diskette and print all or part of the worksheet on a printer.

B. VisiCalc made easier.

1. VisiCalc.

   a. Using VisiCalc tutorial, it can be learned, but it can be made a great deal easier
   b. Cdex will help to make VisiCalc learning much easier

      1. Not meant to totally replace VisiCalc
      2. Used to teach the very basics to the innocent learner
      3. Will not teach the advanced VisiCalc techniques
      4. Will take the learner from Visi-learner to a competent user in a few hours

2. Cdex.

   a. Cdex programs come on three diskettes.

      1. Each represents a series of brief lessons
      2. Need not take them in recommended order, but probably should
      3. Progression appears carefully planned

   b. Three-ring binder

      1. Contains 62 page manual
      2. Organized into three sections:

         a. VisiCalc command reference
         b. Seven VisiCalc worksheets
         c. Exercises

   c. Cdex program utilizes:

      1. The text
      2. Graphics
      3. Sound

   d. Cdex is not a substitute for reading and understanding the VisiCalc manual

C. Ventures with VisiCalc.

1. VisiCalc templates.

   a. Application templates are preformatted VisiCalc models
   b. Many templates are commercially available and more are under development

2. Template conversion.

   a. If a template cannot be found to meet needs - convert it

b. Two versions of running VisiCalc on the Apple:

    1. The original thirteen-sector Apple II version
    2. The original Apple II version

        a. Both basically have the same features
        b. Both basically have the same functions

    3. The sixteen-sector Apple II version shares essentially the same functions as the new 1.1 version of VisiCalc III

c. No problem in converting templates designed for the simpler version of VisiCalc to the more advanced version

    1. Possible exception would be memory requirements
    2. Otherwise, should be able to run program

d. If template to convert uses functions that are not on own program of VisiCalc:

    1. First thing is to determine the version of VisiCalc the template was written for
    2. Will have to forego that model
    3. Find a way to program the capability provided by the missing functions

3. Niffuming.

    a. To convert a template developed for sixteen-sector Apple or VisiCalc III to run on a thirteen-sector
    b. Need an outside commercial program to convert sixteen-sector data to thirteen-sector data
    c. Several conversion utilities available

4. Muffining.

    a. To convert any thirteen-sector VisiCalc to sixteen-sector format
    b. Utilize "Muffin" program on the DOS 3.3 master disk
    c. Converted file will run with sixteen-sector VisiCalc

5. DOS to SOS.

    a. Two possible methods:

        1. Using a text file converter program

            a. Simple to use
            b. Self-documenting
            c. Locate at all Apple II dealers
            d. Best to rename all files to conform to SOS file name

2. Reversal of the process
    a. Using Apple II utilities disk that converts Apple Writer II text files to Apple Writer III text files
    b. It will perform same task for VisiCalc files

6. SOS to DOS.
    a. Use the Apple Writer III utilities disk to convert to Apple II sixteen-sector format
    b. If converting to thirteen-sector format, niffum is necessary

7. VisiCalc and Apple Writer.
    a. Apple Writer II and III are easy-to-use word processors
    b. Can be used for writing reports or documents describing the information in VisiCalc files

8. Print-to-disk file.
    a. Cannot be reloaded into VisiCalc
    b. Can be loaded into Apple Writers

D. Does VisiCalc lie?

1. Every computer or calculator that does numerical calculations has areas where answers are not completely accurate.

2. Has to do with the method that the computer or calculator uses for rounding off fractions or decimals.

3. VisiCalc:
    a. Can only carry a decimal value to a specific number of characters or decimal places
    b. For the most part all calculations are accurate
    c. In order to insure no problems, it helps to understand what types of situations can cause error.
        1. Most likely area is extremely small numbers
        2. Leftovers (dividing seven into one)

APPENDICES

Appendix A

Shopping for an On-Farm Computer

American farmers are taking farm management into the computer age. According to Jeff Frack, general manager of Harris Technical Systems, Lincoln, Neb., "market surveys indicate that a large majority of farmers expect to be managing soon with a personal computer."

Farming has become a complex business, and good money management is necessary to produce profits. As farm computer retailer James Gardner, Spiceland, Ind., puts it: "The days of putting bills on a nail or piling them in a shoebox are gone. The bigger farmers -- those with more acres and head of livestock -- are into handling information and are looking at personal computers."

Like other business and professional people, farmers are learning that a personal computer can greatly increase the productivity of their management time. Since management involves money, farmers focus their on-farm computer applications on financial management. Professor Craig Dobbins, Purdue University, finds that farmers attending Purdue's computing workshops are looking for help in two principal areas -- financial record keeping and business enterprise analysis.

Accurate financial records are required for sound farm management. The computer is an ideal tool for storing the farm accounts and for generating the financial reports which must be provided to lenders and accountants. Barry Jarett, Jarett Agri-Sales, Lapeer, Ind., says that "the country bankers now insist upon seeing better records from their customers, and the farmer has to pacify the banker." Moreover, good reports enable the farmer's accountant to satisfy the tax authorities.

Guaranteed privacy

Farmers find that the on-farm personal computer offers advantages over the off-farm accounting records services. Perhaps the most important advantage is privacy. Don Villwock, Edwardsport, Ind., observes that "keeping the records at home ensures that the information about the farm remains private."

In addition, Villwock points to the convenience of having the computer on the farm. The turn-around time for the on-farm computer is immediate as compared with the off-farm records service. Any errors can be corrected quickly as compared to a records service, which might take as long as several weeks. And, once the information is in the on-farm computer, the farmer can use it for enterprise analysis.

Enterprise analysis

Enterprise analysis, which is analyzing the farm's financial information, enables the farmer to manage for profits. George Morgan, The Country Computer Store, Lafayette, Ind., says: "In my opinion, enterprise analysis is the reason for an on-farm system. Enterprise analysis relates the different quantities of physical input to quantities of output. For example, the farmer needs to know how many gallons of L.P. gas are used to produce a pound of pork."

Areas for applying enterprise analysis are numerous in the farm business. An example in crop farming is deciding how much rent can be paid for a farm and still leave a profit. The accounting records on the computer provide the data for the production costs -- the per acre expenses for items such as fertilizer, seed chemicals, fuel, crop drying, freight and interest. The farmer estimates the yields expected from the farm and the prices for the crop and puts this information into the computer. Then, the computer quickly calculates the costs and the projected cash return over these costs. This return indicates the cash which is expected to be remaining to pay for labor, management, equipment and rent.

An enterprise analysis example in livestock production is deciding which gilts to keep back for the brood sow herd. A farmer with a farrowing operation can store all of the needed information about the individual sows in the computer. The computer then uses these records to calculate management statistics, such as litter size, pig survival rate, and weight gain to feed consumption ratios. These and other statistics provide precise comparisons of the sows and gilts for managing the culling and building of the herd.

No farmer has the time or the ability to perform all of these mathematics by hand or calculator. But the computer operates at an amazing rate of speed -- over 500,000 addition or subtraction steps in one second. Unlike the farmer, the computer never gets tired or bored. With the computer crunching the numbers, the farmer spends time evaluating the answers and making decisions.

Better planning

Villwock sees the computer's analysis capability as a key part of better farm management. He says that "asking 'what if' type questions and getting answers based on information from his own operation helps a farmer to plan better for the future." Statistics for management, such as cost-benefit ratios, provide useful guides to where a farmer can most profitably invest his capital in the business.

By pushing a pencil, farmers readily see what the return on an investment in a personal computer can be. As an illustration, Gardner says that "farmers with livestock are interested in computing least-cost feed rations. But they don't like doing the complex math involved in calculating the costs of alternative feed materials. So, they wind up taking what the dealers in the community happen to have on hand. However, the computer can quickly compute the least-cost feed ration. The dollar pay-back in feed savings shows the farmer what the computer can do for him."

Capital investment

A microcomputer is a business capital investment. Under the terms of the Economic Recovery Tax Act of 1981, a microcomputer qualifies for investment tax credit when it is used as a business machine. It is also depreciable. The IRS places microcomputers in the five-year property category for depreciation purposes, although its useful life is far longer.

However valuable as a business tool, an on-farm computer also fits into the farm family life style. Since is is usually located in the home, the entire family can use it. Of course, the family likes the games. But many farmers mention their children's educational needs when explaining why they look at computers. A word processor program enables the microcomputer to operate like a typewriter for correspondence and school reports. Many school math and science textbooks present computer programs for the student to try out. A child living with a computer has the opportunity to become computer literate and be prepared for the future.

Hands-on experience

Farmers are looking into personal computers by attending workshops where they can receive hands-on experience. At the workshops, they can also learn about potential headaches from farmers with on-farm computers. Land grant universities, farm organizations, and computer firms now offer workshops which introduce farmers to on-farm computers. Farmers and spouses are turning out in large numbers for these sessions.

Many of the programs are focused on the interests of those farmers who are just beginning to look into microcomputers. Mel Hollingsworth recently co-ordinated introductory sessions for the Indiana Young Farmers. He said that most of the people at his sessions were "just gearing up their thinking and education on computers. They don't really want to run with a computer but feel that it's a necessity down the road. These people like a panel of farmers describing what they do with a computer on the farm and answering questions from the audience."

The free-wheeling panel discussion also works well to keep computer farmers briefed on new applications and technologies. For example, the people who planned Purdue University's annual on-farm computer use conference based the program around panel discussions. The panel members were a mix of farmers experienced with computers, agricultural extension experts, and represesentatives of commercial hardware and software firms. This format worked to provide a wealth of useful information as well as to stimulate discussion both among the panel members and with the audience.

However, a training session does not need to be a formal one for a farmer to learn. Christmas music playing softly throughout an immense shopping mall provided a restful background as one farmer, Empson Peters, Vallonia, Ind., explored the world of personal computers. A sales display in front of a computer store provided the computer, while several teen-aged whiz kids provided the instruction. By watching the computer enthusiasts show-off to each other how much they knew about the computer system, Peters says he "learned how to operate the disk drives and printer from the keyboard."

Farmers who are just beginning to look into computers usually have a few key tasks in mind that they want the computer to work on. Peters, for example, has several landlords and he feels that a computer might help him "keep track of things for the widows." He also wants the computer to help with the books so that he "can have a feel for the numbers -- know where the money is going." Finally, he thinks that the computer can help him in marketing his grain.

With those tasks in mind, Peters "started looking around to see what's going on." He said that "a big question is the learning curve -- can a guy in his 50's pick this stuff up." To get an answer, he watched the computer enthusiasts in the shopping mall and attended a farm computer conference. He listens carefully to pick up the jargon and find out where experienced farmers say they made mistakes and where they made good choices.

Specific tasks

Villwock also started his computer education with specific tasks in mind. He thought that an on-farm computer could do his accounts faster and more conveniently than his off-farm service. He felt that the computer could help him analyze his financial data so that he could manage more effectively. He also looked for an instant payback in marketing by having the computer.

Appendix A
Buying the Farm's Computer
By James Rowen

Buying a personal microcomputer for the farm is a good news-bad news proposition, but one in which good news probably outweighs the bad.

The good news is that microcomputers are getting small, less expensive, more versatile and sensible for farmers to purchase. The bad news is that the array of manufacturers, models and combinations of equipment are virtually endless, making the selection of a system a lengthy and difficult decision. And while there is an abundance of hardware, there is a widely-recognized shortage of high-quality programming software on the market and, in most cases, programs are written for and usable on only one single brand of hardware, further limiting the availability of software. But all these reservations aside, the speed, flexibility and almost daily expansion of computing technology and application makes ownership of a personal computer a likely investment for many farmers in the next few years.

Take your time in thinking about buying a computer and take more time to evaluate all the models and variations on the market today. Some experts recommend a three- to six-month shopping-around period, and another three-month trial and error span getting to know the computer you've bought. Some companies will allow a trial rental period, and, if this is a possibility, live with your computer for a while before you decide to make the arrangement permanent.

NO PERFECT SYSTEM. And remember, there is no perfect system -- they have all been designed by human beings. There is no system which will make you into a perfectionist bookkeeper if you are a poor manager of records and cannot change your habits. A computer is only as good as the information you put into it, since it will follow your instructions. And just as there is no perfect system, there is also no computer which is objectively "better" than another.

Don't buy more computer than you need. Develop a budget for its purchase, get competitive bids, and spend only what you have deemed necessary.

Professionals in the field, including farmers already using computers, all recommend making a detailed list of the tasks you think could be improved on your farm through computerization. High on most farmers' lists are recordkeeping, enterprise management, market predictions, least-cost ratios and other statistical jobs. Show your list to farm extension personnel and farmer friends already owning a computer.

LEARNING ABOUT SOFTWARE. Once a farmer has reason to believe that he or she can justify the purchase, and will make regular use of the system for farm purposes, the next step is learning about software, hardware, and the new language and terminology which computers and computer users understand.

The cardinal rule in narrowing down the broad field of computing equipment for purchase is: Software first, hardware second. In other words, don't spend a nickle on computing hardware until you have made a thorough review of the software programs which will meet the needs you have outlined on your list of reasons to buy a computer system.

Experts agree, and many farmerswill affirm through firsthand experience, that there has been a shortage of reliable and usable software on the market written specifically for farmers. This is because most programs were produced for other markets -- scientific, educational or non-farm business. Many accounting system programs which vendors offer to farmers are drawn up for non-farm bookkeeping and are of little value to a farmer.

What farm software is available is many times no more than rewritten hand calculations, says Bob Jolly, agricultural economist at Iowa State University. Jolly says that more and better software is just now becoming available.

To compound the problem, nearly all programs are written for use in a specific brand or model of computer. If the program is written for computers made by ABC Corporation, a computer made by XYZ Corporation probably cannot accept and interpret the data. The program language and other aspects of its manufacture will make it incompatible with nearly every machine except the one for which it is written. So again, farmers must find the right programs, and the manufacturer of the program or programs will point the prospective buyer toward the appropriate kind of hardware.

TWO COMPANIES DOMINANT. Most farmers owning a personal computer have purchased either an Apple or a Radio Shack computer because these were the two microcomputers first introduced into the mass market about five years ago. A big question is whether those companies will offer their own, in-house software, or continue to let independent vendors or university extension programmers invent and sell programs which their machines can accept.

Apple's Sales Development Specialist Andy Paul said that Apple might introduce some of its own agricultural programs in 1982, but none has appeared to date. Tandy, the manufacturer of Radio Shack, is also apparently going to let the independent vendors carry the ball for a while. Tandy Vice-President of Research and Development John Paterson says, "We're encouraging universities, hoping they will play a bigger role in agricultural software."

These two manufacturers may feel themselves pushed in both hardware development and software introduction by the giant IBM Corporation, which recently jumped into the microcomputer market with a system competitively priced with Apple's and Radio Shack's. And IBM quickly offered two expensive packages of software in an apparent effort to demonstrate that they are also interested in easing the software crunc
IBM offers a Dairy Herd and Health Management package of programs for $2,000 and a Farm Management Accounting System for $3,000.

NATIONAL SOFTWARE SURVEY. One of the best methods of reviewing available software is in a just-updated national survey of software programs published by Dr. J. Robert Strain, extension economist at the Food and Resource Economics Department, University of Florida, Gainesville, FL 32611. First published in October, 1980, and reissued in March, 1982, Strain has located more than 600 software programs for agriculture, available from vendors all over the country. And he lists them in a cross index by the computer brands and models for which the programs are written, so that a farmer can get a fairly good idea if the program will run on his machine or the kind he is thinking of buying. Strain's survey, available for around $5, is probably the smallest and most valuable expenditure a prospective computer buyer can make.

A prospective buyer should make every effort to select a computer brand that seems to have a good number of the right programs available. In strain's listing, which, while detailed, cannot be said to be complete, programs were found for at least 12 makes: Radio Shack, Apple, Base 2, Campbell Scientific, Commodore Pet, Cromemco, DEC, Intertec Superbrain, Sol, Texas Instruments, Wang and Zenith. And again, due to the early introduction and mass marketing through national dealerships, Radio Shack and Apple showed up most frequently in Strain's survey as the makers for which software was written. More than 100 programs could run on the Apple models, and more than 350 on the Radio Shack machines. Only two were found in this survey for Zenith computers, and one for Wang, since these manufacturers have concentrated their efforts on larger business machines and few programmers are likely to have developed microcomputer programs for them.

NO GUARANTEE. But as we have discussed, there is no guarantee that all the programs usable on the Apple and Radio Shack are of high quality or widespread use to all farmers. Remember -- anyone with a tyepwriter can type out a few pages of instructions, enter a program on a cassette tape or memory disc, put it all in an envelope and call it "a program."

If at all possible, try to find a dealer who stocks or can order the programs you want. Have the dealer set up a program on a computer, and look at the details of the program on the computer screen. Don't get programs that come without comprehensive written instructions or "documentation." As pork producer Richard Moore in Manhattan, Ill., says, "If the program doesn't have an operating manual with it, walk on by."

Florida expert Strain and others state that a farmer-computer-owner can expect to spend on programs what is spent on hardware. It is also possible that as hardware becomes more competitive and more advanced, the prices will continue to drop, making software the bigger ticket item, especially over time. So with software purchases, be especially cautious. Look for the software you need for yourself, and then let it point you toward the make and model of computer that can run those programs.

Shopping for hardware, despite the many makes and manufacturers, will be a simpler process once some software decisions have been made. But again, be patient.

CHECK ON BACK-UP. Before settling on hardware, look for some important information. Will your dealer provide back-up, such as training, notification of new programs, service and repairs? Most farmers eventually buy from a local dealer to guarantee as much back-up as possible.

Many farmers obtained "deals" on home computers through mail order houses, only to be stuck with a $4,000 piece of electronic equipment and not the slightest clue about service, repairs or even detailed instructions. To minimize these kinds of occurrences, Apple has taken legal steps this April to ban further mail order sales by any of its dealers, and their Sales Development Specialist, Andy Paul, says he's looking forward to the day when trained salespersons "go out soliciting the business much like a seed corn salesman."

Training, courses, even classes at the local college or high school are often a necessity for farmers who want to get the maximum use out of their computers. Since microcomputers have typewriter data entry boards, and many adults do not know how to type, learning how to run a computer can begin with a course in typewriting. This is indicative of the time commitment one must take to guarantee that the computer is used to its maximum capability, and does not sit idle or become just a toy for playing video games.

CONSIDER MEMORY SIZE. Another important hardware decision is what size central memory, or central RAM, capacity to purchase. A microcomputer's internal memory is measured in ability to store single characters, or bytes, in units of about 1,000 (actually 1,024). A thousand bytes is a kilobyte, or a K. RAM memories are rated as 16K, 32K, 64K and so on. The more RAM K capacity, the more central memory the computer possesses, the more tasks it can perform and the more data it can store for your retrieval and processing. But the more K capacity, the more the computer costs. Most farmers today consider 32K the minimum amount of basic memory needed for farm operations, with a 48K system giving a good measure of flexibility. Some farmers are purchasing computers with central memories of 64K, but these are for large farms with many enterprises. One note: when a computer is running, it uses some of its K capacity just to operate. Make sure you know how much K capacity is left for you to utilize for storage.

Furthermore, computers have differing abilities to hook into and use outside memory units which increase the K capacity of the system. Outside storage of electronic information can be on one of three kinds of units -- cassette tapes, soft or "floppy" discs or hard discs. Most users now avoid cassette tape memory units, although they are cheap, because it takes time to locate the data you are looking for. The floppies seem to be the most popular outside memory unit, with hard discs providing probably technologically superior memory storage, but also the most expensive. The type of discs for storage seems to be a matter of individual preference, and with capacities of from 100K to 500K, provide a computer user with great amounts of storage "space."

Most users want computing hardware that comes with a "drive" to run one or two discs that can interact, or "interface" with the memory bank in the computer itself. Again, the number of drives with the computer, and whether the drives take hard or floppy storage discs, will alter the price of the system. A recent estimate by Doane's Agricultural Services listed the typical farm's annual record storage needs at 200K, meaning that on one or two $5 floppy discs, a year's records can be stored on a thin plastic disc roughly the size of a 45 rpm record.

PRINTERS AND MODEMS. Two other pieces of equipment are becoming popular with farmers, and there are many manufacturers of these items. These are printers, which connect to the computer and print copies on paper of records in the memory, and telephone hookups, or modems, which allow the computer to send and receive data from other computers, information networks and data banks across the country. Some computers have these devices built-in, while others accept them as add-on accessories. If you want your computer to have these communicative capacities, make sure the brand you are considering comes with them or can easily be adapted for them.

So what will a typical system cost? Again, this is a very hard question to answer, because of the endless variation in makes, models, accessories, and a market which changes every few weeks with new equipment breakthroughs. Entire trade magazines are devoted to new product listings and innovations. Nonetheless, there are some price ranges which should fit most buyers' needs. First of all, a microcomputer, by definition, costs under $10,000. Most cost about half that, depending on the equipment, particularly the internal or RAM K capacity, number of disc drives, and built-in equipment like a printer and modem.

Last May, Oklahoma State University's extension put out cost estimates for "typical system" for ranchers and farmers. They ranged from a basic, "Get by" system for $1,420, with 16K of memory and no storage units or disc drives, to a "first class" system with two disc drives, three discs with 200K storage, and 64K of internal memory for $7,250.

Progressive Farmer of February 1982 surveyed several hundred farmers, analyzed their needs, and came up with a list of 28 manufacturers of microcomputers which could put together an acceptable 48K system for $5,000. The all-important back-up services, ability to accept additional accessories easily and other quality factors are not analyzed in that publication's listings, but it is useful to see that hardware is available in the moderate price range from more than two dozen manufacturers. Without any quality comparisons, these manufacturers are: AVI, Apple, Altos Computer Systems, Commodore, Compucorp, Control Data, Cromemco, Data General, Digital Equipment, Health Zenith, Hewlett-Packard, IBM, Intel, Intertec Data Systems, Lanier Business Products, Nec America, North Star Computer, Ohio Scientific, Osborne Computer, Pertec Computer, Radio Shack, Sharp Electronics, Southwest Technical Products, Televideo Systems, Texas Instruments, Vector Graphics, Zerox, and Zenith Data Systems. Before the end of 1982, there will likely be additional manufacturers in the market, especially Japanese firms and new American and English companies.

PAYBACK CAN VARY. For the farmer who makes a sound purchase, gets the necessary training and finds the right software, how soon will the computer purchase pay off? Payback periods vary, due to the differing tasks and expectations that the computer is supposed to meet. But in many instances, payback periods are brief. A recent Mississippi State University survey of computer users found the average system costing $3,500 and the payback period running from 18 to 30 months. Some farmers reported making their money back immediately because the computer quickly saved them money.

One Illinois hog farmer reported that his computer determined that pig deaths in his farrowing house could be reduced by raising the temperature and changing heating systems. By making the necessary changes, he estimated saving .4 pigs per litter, and "that pays quickly on 500 litters," he said. Another pork producer claimed his computer increased his annual sales by 13 animals, earning him $6,250 in the first year of computer ownership.

In one survey of farmers, 42% using computers reported that they believed their machines "effectively increase(d) their farm revenues," while 45% reported a reduction in costs and an overwhelming 90% reported improvements in control. All these figures seem to indicate the farmers using home computers can cut costs, increase income, and increase efficiencies with the right computer. And it cannot be overemphasized that the right selection and the right training makes the computer more worthwhile. A computer, sitting in a closet in a farmhouse, will not automatically run a farm at a profit. It is only as good as the data put in.

INFORMATION NETWORKS. Many farmers with computers are hooking up with information networks, using their modems to call in questions, and using their computer screens to receive answers. These networks, like private television channels, greatly enhance the value and range of a computer, and open up the farm operation to receive an unlimited amount of data from all over the world. With a ready supply of storage discs, the information flashed on the screen can be placed in storage. With a printer, paper copies can be produced. The telephone modem, for as little as $75, can turn the computer into a window on the world.

Using such established networks as AGNET, The Source and others, the phone line brings into the computer everything from sophisticated programs on hundreds of subjects, to continuous videotext from wire service news reports, such as stock market quotations, or up-to-the minute soil, crop, pest and weather information. And, perhaps more importantly, services can be purchased which supply sophisticated market information, helping even the smallest, most remote producer decide in the right moment to move a crop to market. Other information can be received which can be fed into existing financial programs already in the computer's memory to help a farmer decide whether this is the right time to buy machinery, and, if so, what will be the impact in all areas of his budget and income projections.

Many networks, like AGNET, are run through university extension services. Others, like The Source, Martin Marietta Data System, Pro Farmer Instant Update, Compu Trac, Commodity Computer Services and CompuServe MicroNET, are private commercial ventures. Fees vary from system to system, reflecting initial subscription costs or memberships, minimum monthly charges, and phone costs. There is no way to determine which farmers need or can afford such systems.

AGNET, for example, has about 500 farm subscribers, and about twice that many in farm-related and banking businesses. AGNET costs $50 a year, plus $8-$12 per hour, plus phone charges. Compu Trac, which provides many analytical services plus software and other options, costs $1,875 to join, plus a $200 annual maintenance fee, $100 monthly access charge, plus phone. In other words, there is a great variety in networks and the fees they charge. They are right and affordable for some and not for others. But there is little disagreement that hooking into a network, even if it means using your computer only as a receiving, or "dumb" terminal, gives the personal computer owner on a farm an exponentially larger amount of information to use, store, process and just think about when operating a farm.

With a firm idea of what the computer can do on a particular farm, a budgeted price range and a patient approach to finding the right system and learning how to us it effectively, a farmer can get quick answers and solid predictions to many "what if..." questions about the farm's operations, past, present and future.

Computers and information networks will probably become farming's most powerful tools by the end of the 20th century. And the revolution is already underway.

(James Rowen is a writer and teacher in Madison, Wisconsin. He writes a weekly financial and political column and freelances to various national newspapers and magazines.)

BEST COPY AVAILABLE

Simplifying VisiCalc for your farm.

VisiCalc is possibly the most widely used software package in microcomputing. However, its agricultural applications have been somewhat limited because of the time-consuming or sometimes complex setup necessary to use the programs to their full agricultural management potential. AgDisk technology solves these problems.

AgDisk Templates make VisiCalc programs easy to use for your farm or ranch. No additional setup is necessary. You simply input the data requested. All calculations are made automatically. And almost instantly you have the information you need to make important management decisions.

The innovators in agricultural software.

To justify the investment in a microcomputer, you need quality software that can help you manage your operation more efficiently. Harris Technical Systems designed AgDisk VisiCalc Templates, and all AgDisk software, to achieve this goal.

Whether you're determining the right plant population for a particular field or calculating your after-tax profits, AgDisk microcomputer programming can give you the information you need... quickly and easily.

AgDisk
AgDisk
AgDisk

Each AgDisk package also contains a complete, easy-to-understand manual that clearly explains every AgDisk function. And if a problem should ever arise, professional assistance from Harris Technical Systems is as close as your telephone.

It is this uncompromising dedication to quality and service that has made Harris a leading name in applied agricultural sciences.

Harris Technical Systems, Inc.
624 Peach Street
P.O. Box 80837
Lincoln, NE 68501

AgDisk™

VisiCalc™ Templates

Ag IV - IX - 31

™VisiCalc is a registered trademark of VisiCorp.

BEST COPY AVAILABLE

AgDisk Templates make VisiCalc™ a more useful agricultural management tool.

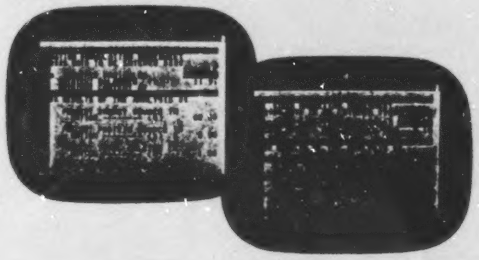
AgDisk VisiCalc Templates are "electronic worksheets" set up for crop, livestock, machinery or general farm and ranch management.

Using AgDisk Templates is as simple as loading the worksheet data diskette into your VisiCalc program and inputting the data requested. All headings and formulas are already in place, eliminating hours of setup. And with a minimal amount of practice, you can even modify a template to meet your special management needs.

AgDisk Templates quickly provide answers to an unlimited number of "What if...?" questions. The electronic worksheets let you change data entries such as prices, costs, interest rates, lengths of time, etc. and instantly see the effects of those changes...before you commit any capital.

In a matter of minutes, AgDisk VisiCalc Template programs can provide information that could take hours, or longer, to work out with pencil, paper and pocket calculator.

The AgDisk VisiCalc Template programs include:



Business Management

These templates can be applied to the general management needs of any farm or ranch. The templates cover tax estimation, depreciation and investment credit analysis, investment calculations, land purchase analysis and financial record a[illegible]sis.

Cow-Calf Herd Management

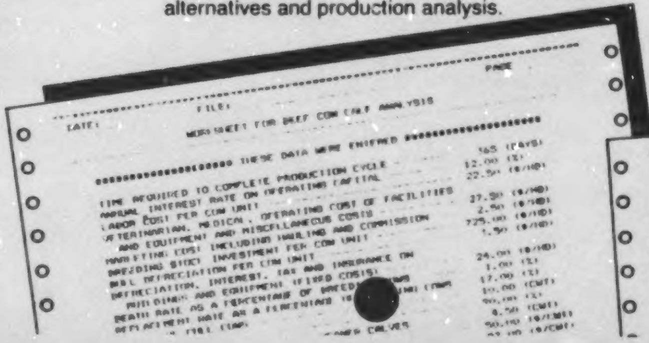
These VisiCalc Templates are specifically designed for producers who pasture and breed cows for the production of calves or yearlings. The package includes templates for projecting profit per head, ration requirements and formulations, adjustment of weaning weights and herd efficiency analysis.

Crop Management

The narrow profit margins in major crops make this an important decision aid for anyone with cropping enterprises. The templates help with a broad range of crop decisions including yield estimates, plant population, harvest losses and an analysis of marketing alternatives.

Feedlot Cattle Management

These AgDisk Feedlot Cattle Management Templates provide important information when finishing cattle for sale to packing plants. The templates can help you save time and money in the projection of profit per head, ration requirements and formulation, selection of marketing alternatives and production analysis.



WORKSHEET FOR BEEF COW CALF ANALYSIS

Machinery Management

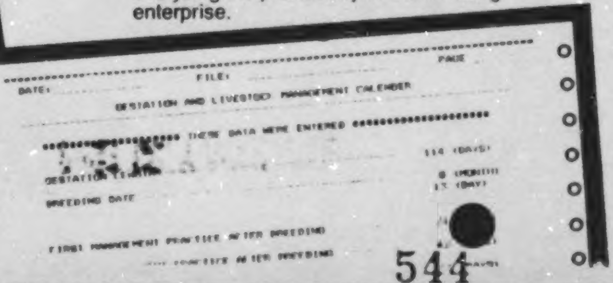
The rising investment in machinery requires accurate machinery management decisions. These templates can provide you with the information you need to calculate machinery costs, calibrate farm equipment and analyze proposed machinery investments.

Swine Farrowing Management

These AgDisk VisiCalc Templates are designed for the producer who breeds sows for the production of feeder pigs. They are applicable to farrowing operations selling feeder pigs as well as those finishing hogs. The templates deal with the production decisions and profitability of a farrowing operation including weaning weight adjustment, sow productivity, enterprise profitability and more.

Swine Finishing Management

The AgDisk Swine Finishing Management Templates take the guesswork out of finishing hogs for sale to meat packers. The worksheets help those who purchase or raise feeder pigs in making a variety of production decisions and analyzing the profitability of the finishing enterprise.



GESTATION AND LIVESTOCK MANAGEMENT CALENDER

BEST COPY AVAILABLE

Manage your money as well as your farm.

Rising costs of production and narrowing profit margins make good financial management an important part of every successful farm or ranch operation. That's what makes the Financial Management AgDisk such an important management tool.

Financial Management programs let you quickly analyze hundreds of management alternatives, so you can spend time and money where you will receive the highest return on investment. You will be able to make the best possible financial decisions based on up-to-the-minute facts, knowing where those decisions will take you.

And best of all, you will be able to bring the same kind of efficiency you need in the production side of your business to the financial side of your business. And that might make the difference between profit and loss.

The innovators in agricultural software.

Your first look at an AgDisk program shows you this is a quality product. Different types of functions are color-coded on the screen for instant identification. Large, easy to read letters are used. Everything is controlled by clear instructions on the screen, no "secret codes" to memorize. A built-in sample demonstration takes you step by step through each program. If you make a mistake in entering data, recovery is simple and immediate. And computer-printed data entry worksheets make using AgDisks faster and easier.

AgDisk
AgDisk
AgDisk

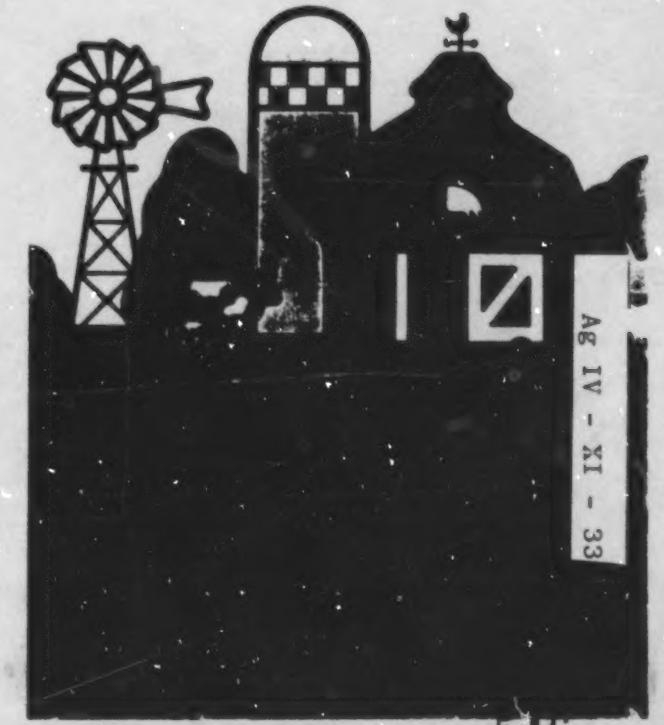
Each AgDisk package also contains a complete, easy to understand manual that clearly explains every AgDisk function. In the unlikely event that a problem should arise, professional assistance from Harris Technical Systems is as close as your telephone.

Dedication to quality products and reliable service have made Harris a leading name in applied agricultural sciences.

Harris Technical Systems, Inc.
624 Peach Street
P.O. Box 80837
Lincoln, NE 68501

AgDisk™

Financial Management
Series One



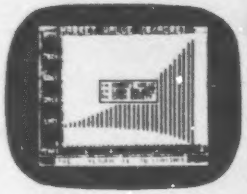
Ag IV - XI - 33

BEST COPY AVAILABLE

AgDisk gives you the information you need to make money management decisions.

The AgDisk Financial Management-Series One diskette contains five different programs, each dealing with a specific area of money management. Every program is specially designed to be easy to use and easy to understand. No previous experience with computers is required. Each program provides step-by-step instructions. And most importantly, the programs are designed to help you make sound financial decisions by providing information on hundreds of financial alternatives. The programs are:

Land Purchase Analysis



The high cost of land requires an in-depth cash flow analysis before any purchase decision is made. This Land Purchase Analysis program will help you accurately calculate cash flow per acre, ratio of borrowed money versus market value, loan balance per acre, loan payment per acre and more.

A Market Value Graph is included in the program to graphically illustrate your projected market value of land, the loan balance, and your equity. A convenient cash flow summary is also provided for each year of the loan.

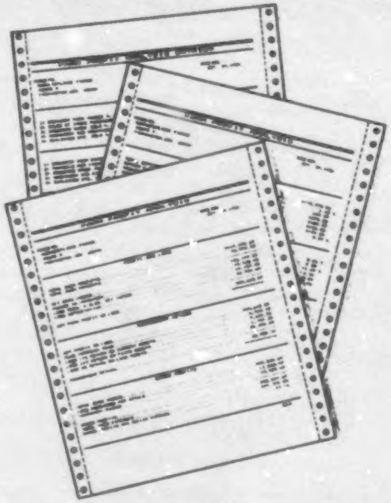
Depreciation Schedules

Setting up the right depreciation schedules can provide dramatic tax savings. This AgDisk Financial Management program lets you build individualized schedules using straight line, declining balance [illegible] sum-of-the-year's-digits methods. You can then use the program to decide which schedule offers the greatest tax benefit for your depreciable assets. The printout of depreciation schedules makes tax preparation even easier.

Farm Profit Analysis

Analyzing profit can be as important as making that profit. AgDisk makes the analysis easy.

You begin this program by entering pertinent financial data from your farm or ranch. You are then able to review or change any of the entries to accommodate changes in your operation, or you can use this program to set up several "what-if" situations. You will know almost instantly the consequences of a variety of different options . . . all without having to actually take a financial risk.



Detailed profit reports can also be printed. Printouts make an excellent permanent record and can be a valuable tool when discussing matters with your banker.

Loan Cost Calculator

The cost of money has a great impact on current financial decisions. That's what makes the Loan Cost Calculator program so useful. You will use this program regularly to set up hypothetical loan situations for instant evaluation. You control all loan variables, including payment frequency . . . monthly, quarterly, semi-annually or annually.

You can then quickly analyze loan options by calculating the effects of various down payments on installments, the effect of balloon payments on loans, the amount of interest paid on a loan at various interest rates and a host of other hypothetical loan situations. The program will even run in reverse, just set the maximum affordable payment and let the program calculate the terms.

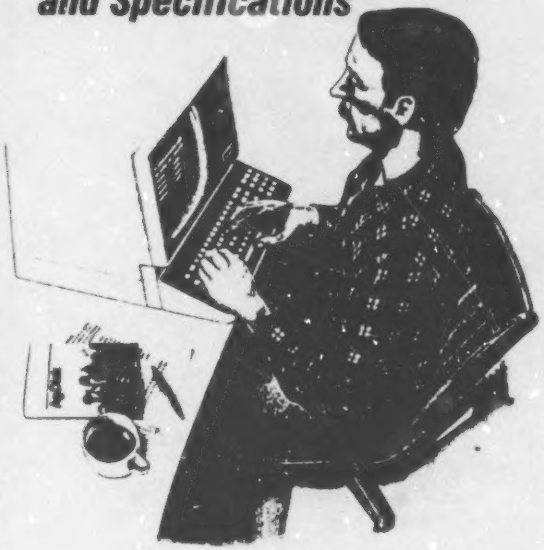
Interest Income Calculator

The Interest Income Calculator program is a valuable tool in determining the best use of capital. You can calculate the advantages and disadvantages of leasing or purchasing large ticket items. You can further determine whether capital would be best used in alternative investments such as stock or certificates of deposit. The program is designed to rapidly calculate interest income and the future value of an investment given a particular interest rate and compounding method.

Like other AgDisk Financial Management programs, the Interest Income Calculator printout can serve as important documentation when discussing future plans with your lender.

BEST COPY AVAILABLE

Program Capacities and Specifications

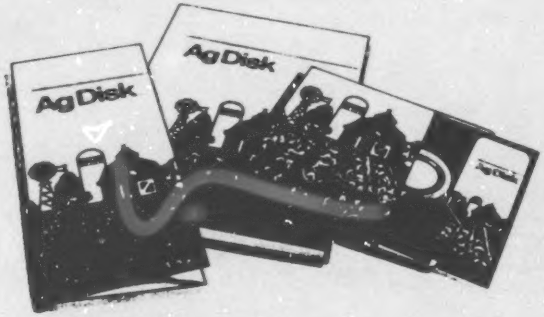


Base Account List	250 Accounts
Enterprise Account List	Virtually Unlimited Accounts
Checking Accounts	9 Accounts
Balance in Single Account	$99,999,999.99
Accounts Payable	30 Names
Amount Owed Per Account Payable	$99,999,999.99
Payments Per Year	Unlimited Transactions
Payments Per Batch (Detail Report)	100 Transactions
Payment Batches Per Period	99 Batches
Distribution Accounts Per Payment Transaction	7 Accounts
Bills Per Year	Unlimited Transactions
Bills Per Batch (Detail Report)	100 Transactions
Bill Batches Per Period	99 Batches
Distribution Accounts Per Bill Transaction	7 Accounts
Deposits Per Year	Unlimited Transactions
Deposits Per Batch (Detail Report)	50 Transactions
Deposit Batches Per Period	99 Batches
Distribution Accounts Per Deposit Transaction	7 Accounts
Adjustments Per Year	Unlimited Transactions
Adjustments Per Batch (Detail Report)	50 Transactions
Adjustment Batches Per Period	99 Batches
Amount of Any One Transaction	$999,999.99
Summarized Transactions Per Period	400 Transactions
Number of Periods Per Year	1 thru 99 Periods

The innovators in agricultural software.

To justify the investment in a microcomputer, you need quality software that can help you manage your operation more efficiently. Harris Technical Systems designed the AgDisk Farm Accounting Package, and all AgDisk software, to achieve this goal.

Whether you're determining the right plant population for a particular field or calculating your after-tax profits, AgDisk microcomputer programming can give you the information you need . . . quickly and easily.



Each AgDisk package also contains a complete, easy-to-understand manual that clearly explains every AgDisk function. And if a problem should ever arise, professional assistance from Harris Technical Systems is as close as your telephone.

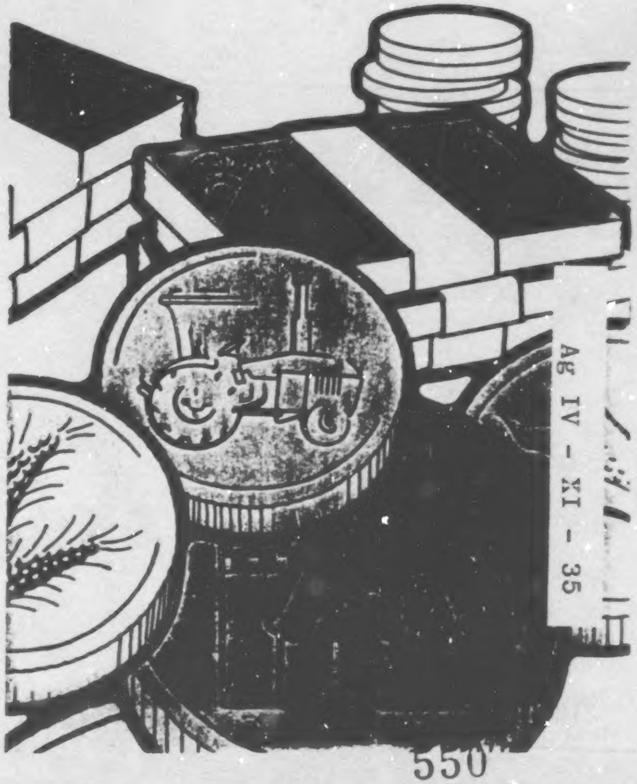
It is this uncompromising dedication to quality and service that has made Harris a leading name in applied agricultural sciences.

Harris Technical Systems
624 Peach Street
P.O. Box 80837
Lincoln, NE 68501

[illegible]

AgDisk™

Farm Accounting Package



Ag IV - XI - 35

BEST COPY AVAILABLE

AgDisk helps you keep thorough records with a custom-designed accounting system.

The AgDisk Farm Accounting Package makes better record keeping easier and faster. With the AgDisk system, you can have double-entry accuracy with the ease of a single-entry function, using either cash or accrual basis.

No previous computer experience is necessary to run the program. Just as important, you don't need any accounting knowledge to use this specially designed package.

To help save time, the AgDisk accounting package has six preselected account lists which cover most farm or ranch operations. You can easily modify these account lists to fit your exact accounting needs.

In addition, you control the length of an accounting period, all report headings, the sequence in which reports are printed and much more. The system does exactly what you want it to do.

Easy-To-Understand Manual

AgDisk Farm Accounting includes a thorough 230-page manual, divided into 15 convenient sections. Examples of the helpful chapters include: accounting basics, backing up diskettes, entering transactions, how to use accounts payable and more. Every program function is explained with the actual screen displays you'll see when running the program.

Accounts Payable Option

AgDisk Farm Accounting includes an accounts payable option which can be a valuable addition to your accounting system. Accounts payable gives you a current, detailed review of all outstanding debts and lets you keep accurate records on how much you owe specific accounts.

It also gives you the flexibility to charge expenses in the month a debt occurs rather than in the month a debt is paid. This accrual system may more accurately report net income and be a valuable aid in determining short- and long-range cash flow.

AgDisk Detailed Report Features

This easy-to-use package is designed to create a set of important financial reports that cover all aspects of your operation. These reports can be used for tax preparation, loan documentation, management decisions, long-range planning or simply to gauge financial performance.

AgDisk Farm Accounting reports include trial balance, income statement, balance sheet, period-to-date registers and optional accounts payable lists.

The AgDisk income statement can be one of your most useful financial tools. It monitors every account to provide a current accounting period and running total for the year's profits or losses. It can give you an immediate reading on your financial condition.

On the income statement, expenses are deducted from farm income to show total farm income, pretax profit or loss and after-tax profit or loss. Expenses are also shown as a percentage of total farm income so you can tell proportionately how funds are being spent.

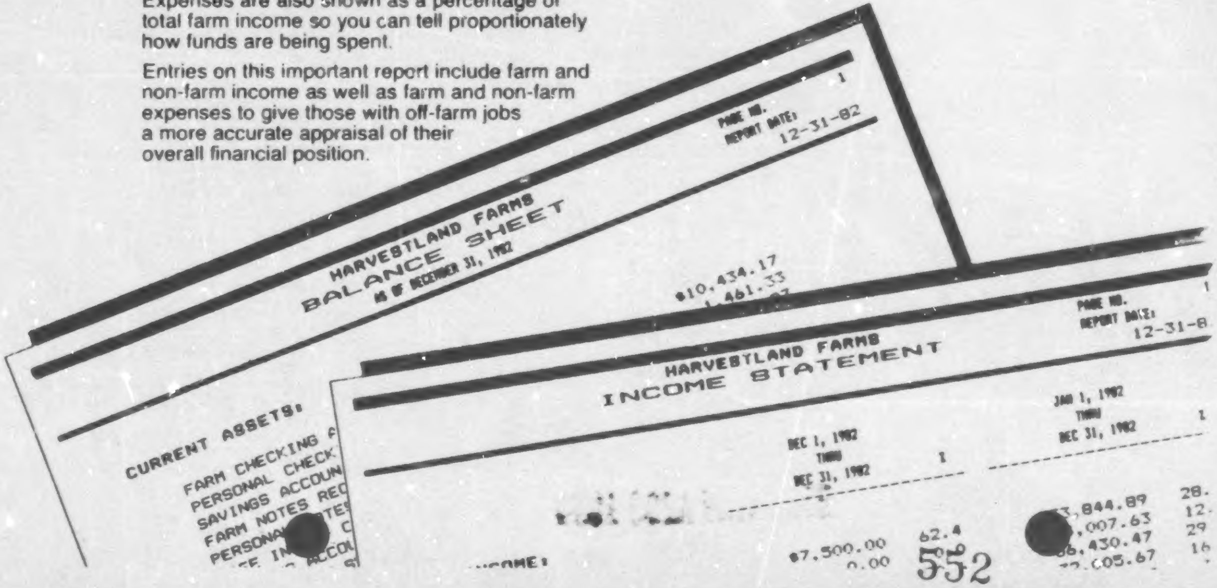
Entries on this important report include farm and non-farm income as well as farm and non-farm expenses to give those with off-farm jobs a more accurate appraisal of their overall financial position.

Modular Expansion Options

The ability to make the best use of a microcomputer for accounting will be largely determined by the software's ability to adapt to your accounting procedures. The AgDisk Farm Accounting Package has an almost limitless ability to do just that with the addition of modular expansion options.

These extension programs add considerable flexibility to the system and enable you to custom-tailor the accounting package to meet specific record keeping objectives.

Some of the modular expansion options for you to add to your basic AgDisk Farm Accounting Package include check writing, enterprise analysis, payroll, cash flow, commodity worksheets, loan amortizations, interest calculations and personal budgets.



PAGE NO. 1
REPORT DATE: 12-31-82
HARVESTLAND FARMS
BALANCE SHEET
AS OF DECEMBER 31, 1982
CURRENT ASSETS:
FARM CHECKING A
PERSONAL CHECK
SAVINGS ACCOUN
FARM NOTES REC
PERSONAL NOTES
$10,434.17
1,461.33

PAGE NO. 1
REPORT DATE: 12-31-8
HARVESTLAND FARMS
INCOME STATEMENT
DEC 1, 1982 THRU DEC 31, 1982 %
JAN 1, 1982 THRU DEC 31, 1982 %
$7,500.00 62.4
0.00
3,844.89 28.
,007.63 12.
6,430.47 29
,605.67 16

BEST COPY AVAILABLE

A new balance in production and marketing.

Since the introduction of the moldboard plow, the production tools and skills used in agriculture have improved dramatically. The result has been the most bountiful production of food and fiber in history.

But while America's farmers and ranchers were continually finding ways to increase production, little was done to improve the methods they used for marketing their commodities.

The AgDisk Market Charting Package is a reversal of that trend. It gives farmers and ranchers, or anyone involved in commodity trading, the information they need to make knowledgeable commodity buying and selling decisions.

Science and technology helped agriculture evolve from subsistance to abundance. Now AgDisk Market Charting has brought the same technological advantages to commodity marketing.

The innovators in agricultural software

To justify the investment in a microcomputer, you need quality software that can deliver vital information, fast. Harris Technical Systems designed the AgDisk Market Charting Package, and all AgDisk software, to achieve this goal.

Whether you're determining the right plant population for a particular field or charting commodity trends, AgDisk microcomputer programming can give you the information you need . . . quickly and easily.

AgDisk
AgDisk

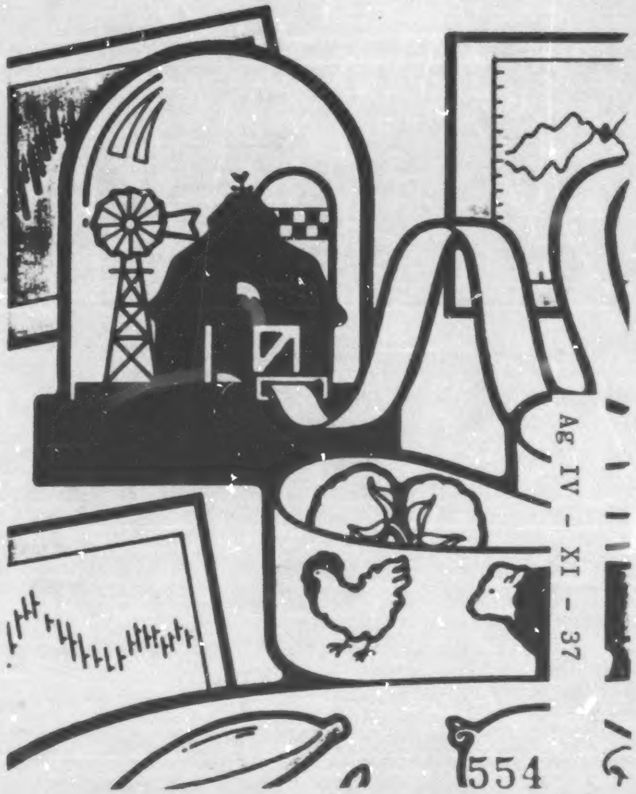
Each AgDisk package also contains a complete, easy-to-understand manual that clearly explains every AgDisk function. And if a problem should ever arise, professional assistance from Harris Technical Systems is as close as your telephone.

It is this uncompromising dedication to quality and service that has made Harris a leading name in applied agricultural sciences.

Harris Technical Systems, Inc.
24 Peach Street
P.O. Box 80637
Lincoln, NE 68501

AgDisk™

Market Charting Package



Ag IV - XI - 37

BEST COPY AVAILABLE

AgDisk gives you the software you need for better marketing management.

Ag - IV - XI - 38

The AgDisk Market Charting Package is designed to help you make commodity buying and selling decisions based on thorough market information. AgDisk lets you chart 32 commodities for up to 450 trading days per data disk, making in-depth market data easy to obtain and easy to understand.

No previous computer experience is necessary to operate the AgDisk Market Charting Package. For your convenience, two sample commodities have already been entered. These can be used as a guide to help make your first entries easier. The program also provides step-by-step instructions and built-in safeguards to prevent errors. For example, AgDisk programming will not allow reference dates to be entered on days when markets are closed.

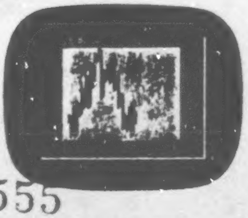
The capabilities of the AgDisk Market Charting Package can also be expanded with the addition of Market Access and Market Forecasting extension modules. These options supply up-to-the-minute quotations automatically and enable you to make realistic market projections.

Commodity Charting

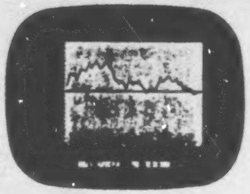
The AgDisk Market Charting Package gives you the ability to generate several different types of charts along with printouts for convenient reference.

Bar charts display daily high, low and closing prices over a specific period of time.

Point and figure charts show commodity price movements. You simply program what you consider significant price changes. The program then displays the charts showing these significant price move[illegible]



Basis charts let you compare the difference between a futures contract price and a local cash price.

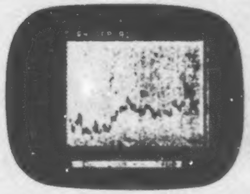


Spread charts use special graphics to show long and short commodity positions.

Chart Features

The AgDisk Market Charting Package offers several features that make the charts easier to use and understand. The "ZOOM" feature enables you to literally zoom in on a portion of a chart, magnifying the scale of the quotes between two specific prices.

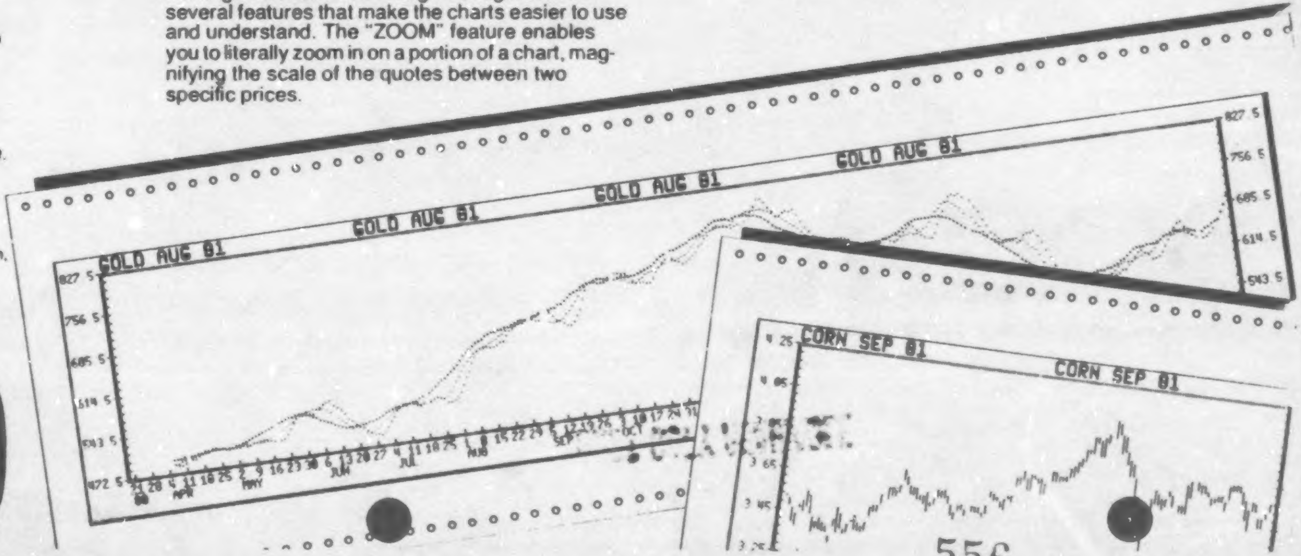
The program also has the ability to let you see segments of the charts with new dates. By pressing the arrow keys either left or right, you can move the chart forward or backward approximately 50 days.



NORMAL

ZOOM

A trendline can also be established using the bar chart to show the general direction of prices for a given commodity. By simply pressing two buttons to establish a beginning and end period, a trendline will be drawn to show price movement within that period of time.



Rising machinery costs make AgDisk one of your best farm management tools.

The AgDisk Machinery Management programs let you quickly and easily analyze hundreds of management alternatives and choose the ones that are best suited to your operation. Whether calculating the cost per acre of operating a combine or weighing the benefits of a lease, AgDisk delivers the information you need to receive the best return on your machinery investment. You will be able to make management decisions based on up-to-the-minute facts. And you'll know where those decisions will take you.

You will be able to take the guesswork out of the decision to custom hire work or purchase equipment to do the job. You will be able to weigh the benefits of machinery ownership versus leasing based on current and projected interest rates. And you will be able to accurately calculate operating costs and loan costs to make the most of every machinery dollar.

Efficient production requires large expenditures for equipment. The Machinery Management AgDisk can help you make those expenditures in the most efficient way.

The innovators in agricultural software.

Your first look at an AgDisk program shows you this is a quality product. Different types of functions are color-coded on the screen for instant identification. Large, easy to read letters are used. Everything is controlled by clear instructions on the screen, no "secret codes" to memorize. A built-in sample demonstration takes you step by step through each program. If you make a mistake in entering data, recovery is simple and immediate. And computer-printed data entry worksheets make using AgDisks faster and easier.

AgDisk
AgDisk
AgDisk

Each AgDisk package also contains a complete, easy to understand manual that clearly explains every AgDisk function. In the unlikely event that a problem should arise, professional assistance from Harris Technical Systems is as close as your telephone.

Dedication to quality products and reliable service have made Harris a leading name in applied agricultural sciences.

Harris Technical Systems, Inc.
624 Peach Street
P.O. Box 80837
Lincoln, NE 68501

BEST COPY AVAILABLE

AgDisk™

Machinery Management
Series One

Ag IV - XI - 39

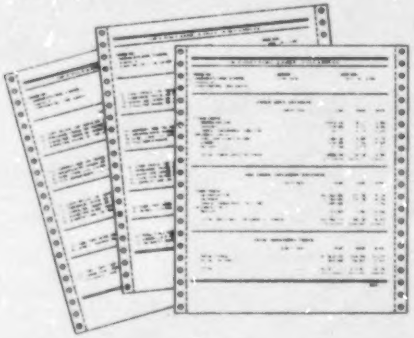
BEST COPY AVAILABLE

AgDisk provides the information you need for more efficient machinery management.

The AgDisk Machinery Management-Series One diskette contains four different programs, each dealing with a specific area of machinery management. Every program is designed to be easy to use and easy to understand. No previous computer experience is required. Each program provides step-by-step directions. And most importantly, the programs are designed to help you make sound management decisions by providing information on literally hundreds of management alternatives. The programs are:

Operation Cost Estimations

An important consideration when buying any piece of machinery is its cost . . . not just the purchase price, but the cost of ownership and operation as well. This program is designed to provide that information.

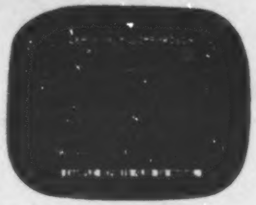


By entering basic inputs about virtually any piece of machinery used in agriculture, AgDisk can quickly determine costs per year, cost per hour and cost per acre for depreciation, interest, taxes, insurance, housing, fuel and lubrication, labor and repair. Then total fixed costs and total variable costs are calculated. You can also change any of your inputs to create "what if" buying situations. For example, you can calculate the change in operating costs by substituting various figures for horsepower ratings, years of ownership, fuel types or interest rates.

The program also contains an easy-to-read graph that illustrates how operating costs change as machinery use increases.

A printout of the Operation Cost Estimations program can be made for a permanent record of projected machinery costs. The printout can also be an excellent tool when establishing a line of operating credit with your lender.

Lease/Buy Comparison



The decision to lease or buy equipment can be very important. The wrong decision can also be very expensive. That's why the Lease/Buy Comparison program can be so helpful.

You simply enter basic purchase and depreciation information. Then AgDisk quickly calculates the cost of purchasing equipment.

Basic lease information is also entered and calculated. The program compares the cost of purchasing equipment side-by-side with the cost of leasing. The difference in cost is also calculated to give you the facts you need to assess your options.

This program provides an excellent opportunity to create "what if" situations by inputting different variables such as tax credits, depreciable life or down payments. You can then determine what adjustments might be made to make either buying or leasing more advantageous.

Ownership/Hire Comparison

This AgDisk program is designed to give you the facts you need when deciding whether to invest in equipment or custom hire.

You enter basic information such as your estimated ownership operating costs (obtained from other programs on this diskette), custom hire costs, estimated acres covered and general tax bracket.

The program quickly calculates the cost of ownership per year and per acre, less tax savings, and total cost of custom hiring on the same. Then a side-by-side comparison shows which is more expensive.

Printed reports of the Ownership/Hire Comparison program may also be made for a permanent record.

Loan Cost Calculator

The cost of money can be just as important in making equipment purchase decisions as the cost of the equipment under consideration. That's what makes the Loan Cost Calculator program so useful. You will use this program regularly to set up hypothetical loan situations for instant evaluation. You control all loan variables, including payment frequency . . . monthly, quarterly, semiannually or annually.

You can then quickly analyze loan options by calculating the effects of various down payments on installments, the effect of balloon payments on loans, the amount of interest paid on a loan at various interest rates and a host of other hypothetical loan situations.

Appendix C

Single vs Double Entry Debate
Which is right for you?

Probably more confusion is caused, and misinformation published, on the topic of single versus double entry accounting methods than any other aspect of farm computerization. Many "expert" recommendations today are based on total ignorance of the practical capabilities of modern computers and software. To make matters worse, few farmers understand accounting principles well enough to make informed decisions when choosing between the two systems. We will not attempt to resolve this issue once and for all since there is no one system that is right for every type of farm business. By studying the following examples, though, you will be better prepared to match a program to your unique needs.

DOUBLE-ENTRY ACCOUNTING

Few farmers are familiar with this bookkeeping system, although it is widely used by other types of businesses. Double entry's major strength is accuracy, especially as a manual bookkeeping method. Each transaction actually involves two offsetting entries. For instance, an expense such as fertilizer would be entered as a positive entry (credit) into an expense account for fertilizer, while at the same time, an offsetting negative entry (debit) is made to the cash account from which the bill was paid. If double entries are made correctly, the books should always be in balance.

The second major advantage of double entry accounting is its ability to generate accurate financial statements. In addition to income and expense accounts, assets and liability accounts are also necessary.

Accrual Method

Balance Sheet

Date	Transaction	Assets Cash	Inv.	Receivables	Liabilities (Payables)	Net Worth	Accrual Income
Dec. 5 1982	Seed Corn Delivered		3800		3800	0	-3800
Jan. 1 1983	Pay for Seed Corn	-3800			-3800	0	-3800
Jan. 15, 1983	Deliver for Customer		-3800	5000		1200	1200
Jan. 31, 1983	Receive Payment	5000		5000		1200	1200

Figure 1

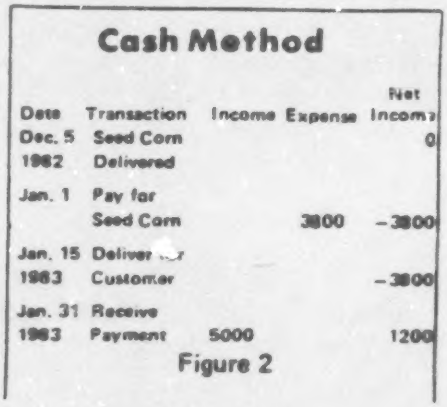
Figure 1 is an example of how these accounts interact for a seed corn dealer. Notice under the Balance Sheet there are three asset accounts: CASH, INVENTORY and ACCOUNTS RECEIVABLE, and one liability account, ACCOUNTS PAYABLE. On December 5th, seed worth $3800 is delivered to the farmer's warehouse along with an invoice. His inventory account is credited to show the value of that seed (asset). Since he has not paid for the seed yet, he must make an offsetting entry to ACCOUNTS PAYABLE (liability). He accrues an expense of $3800, and his assets in seed inventory are exactly offset by the liability from ACCOUNTS PAYABLE, representing no change in his net worth.

The next transaction on January 1st involves payment of that bill. Of course, the appropriate EXPENSE account must be increased by $3800, but offsetting entries also need to be made to reduce ACCOUNTS PAYABLE and CASH accounts by the corresponding amount.

Just the opposite situation occurs when the seed is delivered to the customer. The inventory account is reduced by its wholesale cost, but it is more than offset by an increase in a third asset account, ACCOUNTS RECEIVABLE, by the retail price owed by the customer.

With the last transaction, January 31, payment of $5000 is recorded in an INCOME account, resulting in a NET CASH INCOME of $1200. Entries must also be made to increase the CASH account and decrease the ACCOUNTS RECEIVABLE account.

Accountants find this method of bookkeeping desirable because an accurate financial "shapshot" can be taken of the balance sheet at any time. Notice that the NET WORTH column is kept current with each transaction.



Cash Method

Date	Transaction	Income	Expense	Net Income
Dec. 5 1982	Seed Corn Delivered			0
Jan. 1	Pay for Seed Corn		3800	-3800
Jan. 15 1983	Deliver [illegible] Customer			-3800
Jan. 31 1983	Receive Payment	5000		1200

Figure 2

Related to the balance sheet is the ability of double entry systems to generate accrual income statements. Compare the NET CASH INCOME column in Figure 2 with the NET ACCRUAL INCOME in Figure 1. Accrual income reflects income and expenses as they are accrued, not necessarily when cash changes hands. In this example, the seed is expensed in 1982 by the accrual method but not until 1983 by the cash method. While most farmers pay taxes based on cash basis, accrual records clarify the distortions often caused by "tax planning" so that a more accurate financial picture is available.

DOUBLE-ENTRY DISADVANTAGES

If the double-entry method has so much flexibility, why do so few farm operations use this system? Basically, it is just not worth the trouble. For example:

1. The four transactions in Figure 1 require 11 separate entries to complete.

2. Few farmers have any need for Accounts Receivable and few bother with Accounts Payable. To utilize these features, a farmer must enter each transaction at least twice (payable, then expense, or receivable, then income). Accrual information may only be required once or twice a year in financial statements, therefore, the time spent figuring these items once or twice manually each year is much less than what would be required for two entries for every transaction.

3. Most farmers pay taxes on cash basis, so accurate accrual information is not so important.

4. Double-entry bookkeeping is designed for accountants, not farmers. What may be routine for an accountant can be a time-consuming struggle for a farmer to adopt and maintain.

5. Just because a program claims to be "double-entry" does not mean that it will generate useful information for the farmer. Many so-called farm accounting programs are nothing more than "quickie" conversions of standard double-entry packages, which are fine for retailers or manufacturers, but have no ability to do enterprise analysis on a typical farm.

SINGLE-ENTRY BOOKKEEPING

Most farmers are familiar with some form of single-entry recordkeeping -- state farm management associations systems, "mail-in" record services or "pegboard" systems. Computerized versions are just as plentiful, from simple check balancers to sophisticated enterprise analysis programs. Transactions are normally entered once and charged to either income accounts as deposits are made, or expense accounts as checks are written. Errors are checked by comparing records with the actual bank balance or by determining that sources of dollars equals uses of dollars in a cash flow. Because input is usually based on cash expenditures and receipts, generally only a cash income statement can be derived from single-entry records.

WHICH IS BEST?

Fortunately, some computer programs are able to incorporate the best features of both systems. Although only one entry may be required per transaction, the computer will automatically make an offsetting entry in a second account. Accounts can sometimes be defined to encompass many features usually unique to double-entry systems such as accounts receivable or payable. In fact, the amazing thing is the number of double-entry programs still on the market which do not yet take any advantage of the computer's capabilities. Computers can transpose values and make offsetting entries much faster and more accurately than humans, yet many programs still require this be done by hand!

Of greatest concern to the user, then, should be the quality of information a system provides, not its arbitrary classification. In order to provide accurate farm financial records, these items need to be fed into and stored within the record system.

1. Record of liabilities: Most likely these will be long, intermediate and short-term loans.

2. Liquid asset accounts, such as checking, savings, commodity, ready-asset or petty cash accounts.

3. Inventory of fixed assets along with means of computing depreciation on those assets.

4. Current inventories of crops, crop inputs, livestock and feed.

Item #4 is by far the most difficult to maintain. Programs must be written specifically for those farm applications, updating inventories as commodities are produced and transferring that data automatically to the financial statements.

Our advice: Do not take blanket advice from anyone, even us! Define the unique record needs of your business and then shop for the software which provides you with the best end result without requiring unnecessary entries or time on your part. Remember, your accountant may not be a computer expert, either, so be sure both he and you make an objective evaluation, so that you find an accounting system that fits your operation.

Newsletter Gets New Look

Computers that communicate via phone lines are not a thing of the future anymore. At least not as far as The Friendly Farm Computer Newsletter is concerned.

The Friendly Farm Computer Newsletter linked modems with Intergraphics, Inc. this issue bringing a new look for the reader.

Intergraphics, Inc. is a publishing house out of Alexandria, Virginia that has been in existence for the past ten years. Their recently published book, A Guide to Personal Publishing, subtitled The Typesetting Service for Personal Computer Users, made possible this intertwining with Intergraphics.

Appendix D

Farm Ledger: An Accounting Alternative
by Stuart Laird

(Editor's note: From his office in Springfield, IL, Stuart is responsible for the decisions affecting his family's nine farms scattered across many states. He first purchased a computer three years ago and has been searching for an accounting system to handle farm records from a landlord's point of view. It's apparent from his comments, however, that this system's versatility makes it adaptable to either the landlord or the operator.)

Farm Ledger/Farm Analyst is a single-entry accounting/analysis system designed by a former PCA loan officer. This review focuses on Farm Ledger.

Of the farm accounting/analysis programs I've seen, this package comes the closest to my idea of the "ideal" system. That's not to say that it doesn't have it's weaknesses. Nonetheless, I have been impressed by it's versatility.

Ease of customization and simplicity of enterprise record-keeping and analysis are the most impressive features of the package. Unlike most packages, account coding (record categories) is defined by the user using words rather than numbers. While the program comes from the supplier with a sample chart of accounts, these definitions are solely for demonstration. The user can define account codes using up to five characters for expense categories, four for income categories. Thus, one expense category might be "fuel," another "phone," and still another "fert," for fertilizer. Each major category can be further divided. Thus fuel might include subcategories, "I.P," "desl," "gas," etc. In total, the system supports up to 18 income accounts, 32 expense categories, and numerous "other" categories which would include payables and receivables. Each account category can further be subdivided into four subaccounts.

Categories and subcategories are further defined by the user as being farm (or non-farm) related, tax significant, or resale related. The user may also decide whether to keep track of units (bushels, head, gallons, etc.) within any category. This feature ties in with Farm Analyst for generating quantities, such as number of bushels sold.

Enterprising is done by inclusion of up to two separate enterprise codes in the data entry process. Thus, for a particular expense item, it can be enterprised both by crop and by owner (landlord or tenant). All analysis is handled by the Farm Analyst modules. (The only major flaw in Farm Ledger is that it is not possible to generate all of the reports by enterprise.)

The system supports numerous printers and can be configured for only one disk drive, if that's all you have. In addition, since all configuration information is stored on the data disk, the system works quite well in situations where you want to run several sets of books. This feature would make the package suitable for bank farm management applications, small service bureaus, or workshops.

Farm Review Panel Rating --
"Farm Ledger"

Ag usefulness	Excellent
Documentation	Good
Error handling	Excellent
Ease of use	Good
Ease of modification	Excellent
"What if" capability*	
Support	Excellent

*Not applicable.

Available from:
Harvest Computer Systems
203 West 11th Street
Alexandria, IN 46001
(317) 724-9527

System requirements
48K Apple II+ or
Apple III in Apple II emulation mode,
1 or 2 disk drives (2 recommended),
80-132 column printer optional, but
advised. VisiCalc optional.

Program cost: $250
Price includes Farm Ledger disks &
100-pg. manual.

Entering transactions is easy, with the system prompting for allowable categories of income and expense. User keys the date, check number (which is automatically incremented), account to or from, description, amount, category, sub-category, and any units. Provision is made for assigning a single item to two different account codes using percentages (50% farm, 50% family, for example). In addition, individual checks can be coded to numerous expense accounts, for proper expense distribution. User is given ample opportunity to check and modify entries before storing to disk. In the event changes are still necessary after storage, system provides an easy-to-use editor to change transactions at a later time. All transactions are permanently stored in monthly transaction files which can span several disks.

If an entry is an expense, user is given an option of writing a check. If he does so, computer prints checks on special forms. One disadvantage is that the system does not store checks for later printing. Each check must be printed as it is written. Along this line, the system does not remember the current check number from one session to the next.

Reports available from the system include Month and Year-to-Date totals by expense category. In addition, the system includes an income/expense detail report so the user can specify criteria by which to sort. System allows complete transaction listing, major account reports, such as notes, accounts receivable, payables, etc. A check register and bank reconciliation report are also possible with the ledger system.

For cashflow budgeting, Farm Ledger includes an easy-to-use VisiCalc template that interfaces with the Ledger Report function (month and ytd). There's a discussion of how to prepare a cashflow budget for those who don't have the VisiCalc program.

Documentation is clear and concise. Manual includes representations of each menu and input screen, along with easy to understand explanations of each step of operation. Not only is the program user-friendly, but I've found the people behind it to be extremely helpful and conscientious. User support is by telephone or letter. Program is copy-protected, but users receive backup diskette when registered with Harvest.

Appendix E

FARMFILER -- FILE PLANNING FORMS

SYSTEM NAME ________________________________

FILE NAME ______________________________ NO: ____

NO. ITEMS (MAX 60) ____ NO. RECORDS ROD (MAX 1000) _______

ITEM NO.	ITEM NAME (MAX 12)	NO. CHARACTERS OR FORMULA	ITEM NO.	ITEM NAME (MAX 12)	NO. CHARACTERS OR FORMULA
1			31		
2			32		
3			33		
4			34		
5			35		
6			36		
7			37		
8			38		
9			39		
10			40		
11			41		
12			42		
13			43		
14			44		
15			45		
16			46		
17			47		
18			48		
19			49		
20			50		
21			51		
22			52		
23			53		
24			54		
25			55		
26			56		
27			57		
28			58		
29			59		
30			60		

NOTES...

1. ANY ITEM BEGINNING WITH 'DATE' WILL BE ALLOCATED 8 CHARACTERS.
2. ANY ITEM COMMENCING WITH '&' WILL EXPECT A FORMULA. FOR EXAMPLE '& AVERAGE' (OF ITEMS 1+2+3) WOULD BE ENTERED AS 1+2+3/#3. NOTE THAT '#' PRECEDES A REAL NO WHEREAS THE 1,2,3 ARE ITEMS ON FILE.
3. A SUM OF CONSECUTIVE ITEMS IS ENTERED AS EG: 1^12 WITH NO OTHER FUNCTIONS OR REAL NUMBERS PERMITTED.
4. A FORMULA CONTAINING DATE+OR-DAYS WILL GIVE A NEW DATE AND THE ITEM NAME MUST BEGIN '&DATE'.
   A FORMULA FOR DAYS BETWEEN DATES IS WRITTEN ITEM NO 1-ITEM NO 2 NO FURTHER FUNCTIONS OR REAL NUMBERS PERMITTED.

5. ANY ITEM COMMENCING WITH '#' WILL EXPECT A NUMERIC VALUE FOR THE DATA ENTERED AND WILL ALLOW FORMATTING IN THE REPORTER SECTION, UP TO FOUR DECIMAL PLACES.
6. THE SCREEN DISPLAYS AND SCROLLS 15 ITEMS AT A TIME, SO IT IS ADVISABLE TO PLAN YOUR ITEMS IN BLOCKS OF 15.

FARMFILER: DATA ENTRY FORM

Farmfiler Model: File No. 1: Sheep Records Ref No.:__________:

1: DATE BIRTH.... : ____/____/____:

2. DATE BRED..... : ____/____/____:

3: RAM........... : __________________:

4: &DATE DUE...... = 2+#147

5: DATE LAMBED... : ____/____/____:

6: # BORN......... : ___:

7. BIRTH WEIGHT.. : ____:

8. SEX........... : ____ __________________:

9. &DATE VACC..... = 5+#3

10: VACCINATED.... :___:

11. CAST/DOCKED... :___:

12. DATE WEANED... : ____/____/____:

13: WEAN WEIGHT... : ____:

14: # WEANED...... :___:

15: 65 DAY WT..... : ______:

16: 120 DAY WT.... : ______:

17: 365 DAY WT.... : ______:

18: COMMENTS...... : ____:

19: DATE REBRED... : ____/____/____:

20: DATE SHORN.... : ____/____/____:

21: LBS WOOL...... : ____:

FARMFILER: DATA ENTRY FORM

Farmfiler Model: File No. 5: Seed Inventory Ref No. :________:

1: LOT #........ : ______________________________:
2: VARIETY...... : ___________________________:
3: FIELD NAME... : ___________________________:
4: FIELD #...... : _________________:
5: CERT. (Y/N).. : ___:
6: TEST #....... : _______________________:
7: LBS IN LOT... = _______________________:
8: &LBS ON HAND.. : 7-27-33-39-45-51
9: PURE SEED %.. : _______________________________:
10: CROP %....... : _________________:
11: INERT %...... : _________________:
12: WEED %....... : _________________:
13: NOX WEED..... : ______________________________:
14: GERM %....... : _________________:
15: FLUOR %...... : _________________:
16: NON-FLUOR %.. : _________________:
17: CROP......... : ___________________________:
18: CROP......... : ___________________________:
19: WEED......... : ___________________________:
20: WEED......... : ___________________________:
21: DATE TESTED.. : _____/_____/_____:
22: DATE TODAY... : _____/_____/_____:
23: &AGE OF TEST.. = 21-22
24: INVOICE 1.... : _______________:
25: PURCHASER.... : _______________:
26: DATE SHIPPED. : _____/_____/_____:
27: AMT. SHIPPED. : _________________:
28: PAYMENT...... : ______________________:
29: &AGE SHIP 1... = 26-22
30: INVOICE 2.... : _______________:
31: PURCHASER.... : _______________:
32: DATE SHIPPED. : _____/_____/_____:
33: AMT. SHIPPED. : _________________:
34: PAYMENT...... : ______________________:
35: &AGE SHIP 2... = 32-22
36: INVOICE 3.... : _______________:
37: PURCHASER.... : _______________:
38: DATE SHIPPED. : _____/_____/_____:
39: AMT. SHIPPED. : _________________:
40: PAYMENT...... : ______________________:
41: &AGE SHIP 3... = 38-22
42: INVOICE 4.... : _______________:
43: PURCHASER.... : _______________:
44: DATE SHIPPED. : _____/_____/_____:
45: AMT. SHIPPED. : _________________:
46: PAYMENT...... : ______________________:
47: &AGE SHIP 4... = 44-22
48: INVOICE 5.... : _______________:
49: PURCHASER.... : _______________:
50: DATE SHIPPED. : _____/_____/_____:
51: AMT. SHIPPED. : _________________:
52: PAYMENT...... : ______________________:
53: &AGE SHIP 5... = 50-22
54: &TOTAL VALUE.. = 28+34+40+46+52
55: &LBS SHIPPED.. = 7-8
56: &AVG PRICE.... = 54/55

FARMFILER: DATA ENTRY FORM

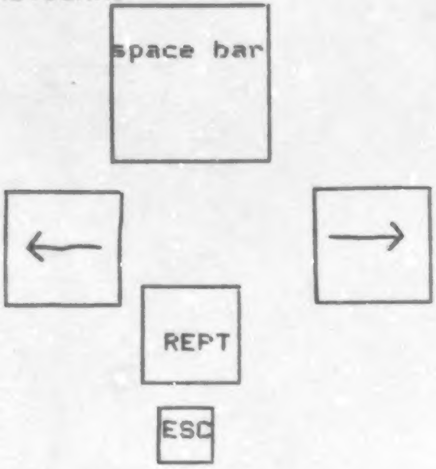
Farmfiler Model: File No. 2: Calf Records #1 Ref No.:_______:

1: TAG NUMBER... :__________:
2: DATE BORN.... :____/____/____:
3: DAM I.D...... :__________________:
4: SIRE I.D..... :__________________:
5: SEX.......... :___:
6: BREED........ :__________:
7: PEDIGREE..... :___:
8: TURNOUT WT... :__________:
9: DATE TURNOUT. :____/____/____:
10: WEIGHT 1..... :__________:
11: DATE WT.1.... :____/____/____:
12: &DAYS T/O-1... = 9-11
13: &ADB - PRD.1.. = 10-8/12
14: WEIGHT 2..... :__________:
15: DATE WT.2.... :____/____/____:
16: &DAYS 1 TO 2.. : 11-15
17: &ADG - PRD.2.. : 14-10/16
18: WEIGHT 3..... :__________:
19: DATE WT.3.... :____/____/____:
20: &DAYS 2 TO 3.. = 15-19
21: &ADG - PRD.3.. = 18-14/20
22: WEIGHT 4..... :__________:
23: DATE WT.4.... :____/____/____:
24: &DAYS 3 TO 4.. = 19-23
25: &ADG - PRD.4.. = 22-18/24
26: WEIGHT 5..... :__________:
27: DATE WT.5.... :____/____/____:
28: &DAYS 4 TO 5.. = 23-27
29: &ADG - PRD.5.. = 26-22/28
30: HOUSING WT... :__________:
31: DATE HOUSED.. :____/____/____:
32: &T/O-HOUSING.. = 9-31
33: &OVERALL ADG.. = 30-8/32
34: BREEDING WT.. :__________:
35: DATE BRED.... :____/____/____:
36: &AGE BRED..... = 2-35
37: HEALTH....... :____:
38: COMMENTS..... :____:
39: .... :____:
40: .... :____:

Appendix F

BEST COPY AVAILABLE

SPECIAL KEYS ON YOUR KEYBOARD:



LOADING VISICALC PROGRAM:

1. Open the door of drive 1 by lifting up on it and then gently insert your VisiCalc program diskette label side up with the label entering last. Close the drive door by pushing down on it until you hear it click.

2. Turn the power switch at the left rear corner of your Apple on.

3. Wait, listen, and watch your screen. Shortly you will see the letters VC in the upper left hand corner of the screen. Soon thereafter you will see the complete screen display(your window looking into the worksheet).

BEST COPY AVAILABLE

MOVEMENT AROUND THE WORKSHEET

>

right arrow

left arrow

space bar

;

ENTERING INFORMATION TO THE WORKSHEET

LABELS:

Any letter or digit preceeded by a " is a label

A label is any entry beginning with a letter or quote. VisiCalc will evalutate any label as a zero. Usually a label is used to give some information about rows and columns. All alphabetic and numeric characters, as well as punctuation and arithmetic operators are allowed in a label. Control characters, however, cannot be included.

VALUES:

Any digit, + , - , (, . , @ is a value.

Value entry is the procedure by which you write numbers and formulas on the worksheet.

BEST COPY AVAILABLE

A formula is an entry on the worksheet that can be used in a calculation. The following are all formulas.

1. Simple numbers like 2, -53, 7.89
2. Numbers written in scientific notation like 1E9 or 5.55E-8.
3. Numbers and arithmetical operators such as 4+45/3*2.
4. Single coordinate value references like +B13 or -AB123.
5. Combinations of numbers, arithmetical operators, built-in functions, and value references like C5 +,(B2-N16)/12, or (@SUM (B2...M2)/N14)*.055.

VisiCalc has the following arithmetic operators:

$\boxed{+}$

$\boxed{-}$

$\boxed{/}$

$\boxed{*}$

$\boxed{\wedge}$

BEST COPY AVAILABLE

SIMPLE EDITING PROCEDURES

If you mistype characters when entering information on the worksheet, you have two remedies:

Press ESC key to erase any mistyped characters.

or

CTRL E to enter the Edit mode

VISICALC COMMANDS

To access the many commands available in VisiCalc type /

B COMMAND:

The blank command erases the label or value at the entry position where the cursor rests without affecting the existing format setting for that position.

1. Place the cursor on the entry position to be erased
2. Type /
3. Type B
4. Press RETURN or an arrow key

C COMMAND:

The clear command irretrievalby erases all information on the worksheet. Clear also performs the following functions:

Returns the cursor to coordinate A1
Blanks all entry positions
Resets the direction indicator to -
Resets all formats, titles, and windows to their initial specification given when VisiCalc is first loaded.

1. Type / C
2. Press Y

BEST COPY AVAILABLE

D COMMAND

The delete command completely erases all entries from the row or column in which the cursor rests at the time the command is given. Once a row or column is removed, it fills in the blank space by moving the next row up or the next column over. The cursor may rest anywhere in a given row or column at the time you execute.

VisiCalc automatically changes all value references in formulas to correspond to the new coordinates which result when rows or columns are moved. It then recalculates the whole worksheet. Hovwever, the ERROR message will appear at any position which refers to entries in the deleted row or column.

1. Type / D
2. Type either R or C

E COMMAND

The edit command allows you to modify Labels or formulas without typing the entire value, formula or word over again. You may delete and insert characters at any position in the entry.
To edit an entry you have already entered onto the worksheet use the following steps:

1. Place the cursor on the entry position you will edit
2. Type / E
3. Move the edit cue with the arrow keys until it is one character to the right of the character(s) you wish to change.
4. Delete characters to the left of the edit cue by pressing ESC key.
5. Insert characters to the left of the edit cue by typing them in
6. Press RETURN

F COMMAND

The format command modifies the display characteristics of any highlighted entry on the worksheet. The actual entry contents remain unchanged in the computers memory.

/FD
The default format command resets an individually formatted entry position to whatever format was previously set with the Global command.

/FG

The general format command sets an entry position to the same format that is in effect when you load VisiCalc. Decimal or scientific notation is selected to display the largest number of significant digits. Labels begin in the leftmost space and are cut off wherever the column width ends. Values are moved as far to the right as possible.

/FI

The integer format command displays all values rounded to the nearest whole number.

/FL

The left justification format command pertains only to values. When you type /FL the value highlighted by the cursor moves to the left.

/FR

The right justification command will move a label to the right of its entry position. It will do the same thing to a value that has been left justified.

/F$

The dollar and cents command rounds all values to two decimal places. It also adds two decimal places to integers. No $ is displayed in the entry position however.

G COMMAND

The gobal command's four options operate in one window at a time. If you have split your screen, only the window in which the cursor resides will be affected. If you have a single window, the Global command will affect the entire worksheet.

/GC

The global column command allows you to change the width of all columns in a window to any number of characters between 3 and 37. Column widths may not be set individually. The global command only changes the appearance of values, not the actual values stored in memory. These values remain unchanged and will be used in all calculations.

1. Type / GC
2. Type in column width.

/GO

The global order of recalculation allows you to tell VisiCalc whether it should recalculate by rows or columns. The order of calculation is indicated on the status area by the letter C or R in the upper right hand corner of the entry line. When you first load VisiCalc, the order is set to column calculations.

BEST COPY AVAILABLE

BEST COPY AVAILABLE

In column order, it begins at coordinate A1 and then works down colum A until it comes to the final entry. Then it jumps to coordinate B1 and works its way down that column, etc.

In row order, it begins at A1, but then continues out Row 1 until the last value in that row is calculated, etc.

1. Type /GO
2. Type either R or C

/GR

The global recalculation option allows you to turn off automatic recalculation in favor manual recalculation. By turning off automatic recalculation, you eliminate the pause that occurs when the program is recalculating.

/GF

The global format command allows you to assign a format setting to all entry positions in the window that you have not formatted individually. The global format command uses the same formatting options as are available for individual entry positions.

I COMMAND

The insert command opens up additional rows or columns in worksheet areas that you have already written in. It is not possible to insert a single entry position. You may only insert an entire row or column.

/IR inserts a new, blank row or column in which the cursor is situated when you execute the command. All rows that were at or below the cursor are moved down or all columns that were at or below the cursor are moved over to make room for the insertion.

VisiCalc then changes all value references in formulas to reflect the new entry position coordinates in the rows that were moved.

VisiCalc will not allow you to insert a row if row 254 is occupied nor will it allow you to insert a column if column BK is occupied.

1. Type /I
2. Type either R or C

M COMMAND

The move command allows you to move an entire row or column to another position on the worksheet. VisiCalc automatically changes all value references in formulas to reflect the new coordinates that result when the rows or columns are moved.

To move a row:

1. Place the cursor in the row you wish to move.
2. Type /M The edit contents line simultaneously shows the "FROM" coordinate (the current cursor position).
3. Press . as the delimiter and three dots will appear on on the edit line after the existing cursor coodinate.
4. Then either type in the destination coordinate or point the cursor to it.
5. Terminate the move command with RETURN

If you want to move a row downward, place the cursor in the row just below the destination coordinate.

To move a column to the right of its current position:

1. Place the cursor on the column you wish to move
2. Type /M and the coordinate of the highlighted entry position will appear on the screen.
3. Press .
4. Point to or type in the coodinates of the column just to the right of the destination column.
5. Terminate the move command with RETURN

P COMMAND

The print command allows you to print your worksheets either to a line printer for hard copy or to another device, such as a disk drive.

With two exceptions, the print command exactly reproduces a rectangle of information from your worksheet just as you see it on the screen. Formats and column widths remain in effect.

The exceptions are (1) windows; and (2) rows and columns that you have Titled. The /P command ignores windows and columns or rows fixed by the titles command.

BEST COPY AVAILABLE

BEST COPY AVAILABLE

To print:

1. Place the cursor in the upper left corner of the worksheet you want to print out.
2. Type /P
3. If you have the printer card in slot 1, type P if not type the slot number and press RETURN
4. Type in the lower right coordinate (representing both the lowest and rightmost points on the worksheet). Or point to the lower right coordinate with the cursor.
5. Press RETURN
6. Printing is aborted by typing CTRL C

PRINTING FORMULAS

To print out formulas and formats, use /SS command. The resulting printout is so complete that you can reproduce a worksheet from it. Follow these steps to save your worksheet to your printer.

1. Type /S
2. Type S
3. Type ,S1 (assuming your printer card is in slot 1)
4. Press RETURN

- COMMAND

The repeating label command repeats any sequence of characters you enter across the entire width of a column. Here is how:

1. Position cursor in the entry position to contain the repeating label.
2. Type /-
3. Type the character label you want repeated
4. Press RETURN
5. Use the replicate command to copy the continuous label as far across the sheet as needed.

R COMMAND

The replicate command allows you to copy the contents of any entry position, including labels, values, formats, and blank entries. You may copy a single entry from one place to another, copy a single entry across a row or down a column, or you may reproduce a single row or column as many times as you like.

BEST COPY AVAILABLE

However, the replicate command does not permit you to copy a row into a column, or to copy a matrix at once.

To use the replicate command, you must supply two (and in the case of value references, three) sets of information:

The source range
The target range
Whether a value reference should be replicated in the same form at all positions or whether it should be made relative to each new entry position.

A range may include from one entry position to an entire row or column. Ranges are specified by entering a starting coordinate for the range, a . (as a delimiter), and the ending coordinate. You can enter coordinates by typing them in or by pointing to them with the cursor. A range may not cross the sheet diagonally.

The source range tells VisiCalc which entry position(s) you want to copy. The target range gives the entry position(s) where the copy should be made.

COPYING FROM ONE ENTRY POSITION TO ANOTHER

To copy from one entry position to another, give one coordinate as the source range and one as the target range. Here is how.

1. Type C Y to clear the worksheet
2. Type some digits in A1 (123 as an example value to replicate)
3. Type /R (by starting the command with the cursor on A1, VisiCalc automatically entered A1 to begin the source range.
4. Press RETURN You have told VisiCalc to begin copying the contents from entry position A1 and to end with A1. The source range is A1...A1 or just one entry position.
5. Type in a coordinate entry position where you want your information in A1 to be replicated. (D1 as an example) This identifies that entry position (D1) as the start of the target range where you want the contents of A1 to be copied.
6. Press RETURN . The replication is complete. The contents of A1 is duplicated where you wanted it to be.

CREATING A COLUMN OF ENTRIES FROM ONE ENTRY

To create a column by making several copies of one entry, give one coordinate as the source range and two coordinates within a single column as the target range. Remember to type a . (delimiter) between the two coordinates of the target range

BEST COPY AVAILABLE

COPYING A COLUMN FROM ONE POSITION TO ANOTHER

To copy a column from one position on the sheet to another, give the top and bottom entry position coordinates of the column as the source range. For instance, A1...A32. For the target range, give only the coordinate of the top entry position of the new column. VisiCalc will fill in the rest.

MAKING SEVERAL COPIES OF A COLUMN

To make several copies of a column, enter the top and bottom coordinates of the source range column and the beginning and ending coordinates of a row as the target range. Each copy of the source column will begin in the target row

COPYING A ROW FROM ONE POSITION TO ANOTHER

To copy a row from one position to another, specify the beginning and ending coordinates in that row as your source range. Then give the beginning coordinate only for the row in which you want the copy to appear. Visicalc will automatically intrepret this target coordinate as the first entry position in a row and will fill in the correct ending position.

REPLICATING VALUE REFERENCES

The replicate command treats formulas containing value references (entry coordinates such as +A1 or +A1 +2) differently that it does labels, numbers, and formats. It gives you a choic as to whether you want value references copied just as it is (NO CHANGE) or with reference to a preceding entry (RELATIVE).

In formulas containing more than one value reference (+B1/A1),replicate offers you this choice for each of the coordinates in the formula. Try this example:

1. Clear the worksheet
2. At A1 type in the digit $\boxed{2}$
3. At A2 type in $\boxed{+}$A1 $\boxed{+}$ $\boxed{2}$ This creates our example.
4. Type /R $\boxed{\text{RETURN}}$
5. Type A3 $\boxed{.}$ A6 RETURN
   The edit line should read A2:A3...A6: +A1 The edit cue over +A1 indicates that +A1 is the coordinate that will be copied into positions A3 through A6. The prompt line is asking whether you want it copied relative to each position or whether you want it to remain the same in each position. Choose no change.
6. Type $\boxed{N}$
7. Now move the cursor down the column. Notice that each copy of the formula contains the value reference A2 just as it was in the source range. This is the result of choosing NO CHANGE instead of RELATIVE.

BEST COPY AVAILABLE

Lets make a direct comparison. Set up an analagous formula in column B and replicate it relatively.

1. Type >B1 RETURN
2. Type the digit 2
3. At B2 type in +B1+2
4. Now enter the replicate command and do it RELATIVE

S COMMAND

The storage command lets you save copies of your current worksheet on diskette, load saved worksheets back into the computer, initialize new diskettes for use with VisiCalc, and gives you a way to quit VisiCalc.

/SL

The storage load command can only load a worksheet back into the computer's memory if the worksheet was saved with the /SS command. Here is how to use this command:

1. Type /S
2. Type L
3. Type the file name used to save the file
4. Press RETURN

VisiCalc offers an alternative to typying in a file name. You can scroll file names from the diskette's directory. To scroll file names, press the right arrow key instead. When the file name you want appears on the edit line, press RETURN.

Directory scrolling also allows you to edit these file names. When a file name is on the edit line, you may change the name by backing up the edit cue with ESC and then typing the characters you wish.

/SS

The storage save command will save the contents of a worksheet to diskette. All formulas, labels, title settings, explicit and global formats and window settings as well as the position of the cursor will be saved and in force when the worksheet is loaded. You can only save worksheets on initialized diskettes.

The save command creates a file for each worksheet saved. You must specify a unique file name for each worksheet file that you save on a particular diskette. A valid VisiCalc file name can have a length of 1 to 30 characters. The first character must be a letter. No commas are allowed.

BEST COPY AVAILABLE

To save a file, follow the steps listed:

1. Type / S
2. Type S
3. Type the file name
4. Press RETURN

/SI

The initialization command causes the VisiCalc program to scan the diskette in the default drive and write a series of position identifiers on it. Any contents on a used diskette will be erased during the process. A diskette must be initialized with /SI before using it to save a worksheet.

1. Insert a bland diskette into drive 1
2. Type /SI
3. Press RETURN

/SQ

This command causes the VisiCalc program to return default to drive 1 (booting whatever diskette is in drive 1) and erases the current worksheet from memory. The purpose of this command is to allow you to boot up a different program.

1. Type /SQ
2. Type the number of the slot containing the card for the drive holding the new boot diskette
3. Press RETURN

T COMMAND

The titles command allows you to fix rows and columns in place so that they remain in view as you scroll the window over the worksheet.

The position of the cursor at the time you initiate the titles command determines which column(s) and/or row(s) VisiCalc will fix as titles.

/TH

The horizontal titles command fixes all rows at and above the cursor.

/TV

The vertical titles command fixes all rows at and to the left of the cursor.

/TB

The both command fixes both row(s) and column(s) at the same time. The rows will be fixed at and above the cursor and the columns will be fixed at and to the left of the cursor.

BEST COPY AVAILABLE

/TN

This command negates the titles command. You can remove titles by typying /TN with the cursor at any position on the worksheet.

The titles command causes no immediate change in the worksheet. However the effect of title fixing becomes apparent when you begin scrolling the window away from the border(s) just fixed. You can not use the arrow keys to move the cursor to an entry position that is within a fixed title area.

$\boxed{W}$ COMMAND

The window command splits your screen vertically or horizontally so that you can view the worksheet through two windows simultaneously. Thus, you can compare rows or columns that are too far part on your worksheet to be viewed through the single window. Once you have split the screen, you can scroll either window independently of the other or scroll them together.

The window command also allows you to set different golobal formats in each window and to look at the same entry position in two different formats.

/WH

The horizontal window command splits the window in two by placing a second column border (A,B,C,...) just above the row containing the cursor.

1. Position cursor in the row below where you want to split the screen
2. Type /W
3. Type $\boxed{H}$

/WV

The vertical window command splits the window by adding a second row border (1,2,3,...) just to the left of the column containing the cursor.

1. Position cursor in the column just left of where you want to split the screen
2. Type /W
3. Type $\boxed{V}$

The vertical window can be particularly useful when you wish to keep a column of information visible in one window while you scroll the other window around to compare columns in different places on the worksheet.

BEST COPY AVAILABLE

/W1
The one window command displaysthe window the cursor was in when you executed the command. The global format settings are put into effect across the entire worksheet.

/WS
The synchronized command synchronizes horizontal motion in horizontal windows or vertical motion in vertical windows so that scrolling the window that contains the cursor causes the other window to scroll too.

/WU
Window unsynchronized turns off synchronized scrolling.

/W1 /WS /WU
These three window commands may only be used after /WH or /WV is in effect.

MORE ABOUT VALUE ENTRIES

ORDER OF PRECEDENCE

VisiCalc performs calculations in the order it encounters each operator from left to right. To change the order of precedence, use parentheses to indicate "do this first". If there are parentheses within parentheses, VisiCalc will calculate the innermost first.

BUILT-IN FUNCTIONS

Built-in functions are used within value entries to save you the effort of setting up commonly used formulas. Each function begins with $\boxed{@}$ followed by the function word, followed by an expression in parentheses (the argument or list). An argument (or list) includes the values (formulas and numbers) upon which the function calculates.

The arguments or list may consist of any combination of values and entry ranges separated by commas. The commas serve as delimiters, to separate individual values. Arguments shown as v may be any legal VisiCalc value.

@Sum (list)	Adds values cited in the list.
@Min (list)	Chooses the smallest value in list.
@Max (list)	Chooses largest value in list.
@Count (list)	Counts non-blank entries in list.
@Average (list)	@Sum(list) divided by @Count (list).
@Abs (v)	Results in the absolute value of v.

BEST COPY AVAILABLE

@Int (v)	Results in the integer portion of v.
@Sqrt (v)	Results in the square root of v.
@Exp (v)	Returns e (2.718..) to the v power.
@Log10 (v)	Results in the logarithm (base 10) of v.
@Ln (v)	Returns natural log (base e) of v.
@Sin (v)	Return the trigonometric function of v.
@Cos (v)	
@Tan (v)	
@Asin (v)	
@Acos (v)	
@Atan (v)	
@Npv (dr, range)	Calculates net present value of cash flows in the range, discounted at the rate specified by dr (Discount rate expressed as a decimal).
@Choose (v,list)	Chooses one of a list of values. The first element (v) is the index to the following list.
@Lookup (v, range)	Looks up a numeric value in a table and finds the value that corresponds to it.

Pesticide Safety

Instructor's Guide:

1. In this unit a copy of the EPA publication "Apply Pesticides Correctly" is provided. These publications can be purchased at your local OSU Extension Office or through the State Department of Agriculture, Salem, Oregon 97310.
2. In this unit is a copy of Study Questions for Private Pesticide Application Candidates. Answers to the Study Questions can be found in "Apply Pesticides Correctly". (Refer to Instructor's Guide #1)
3. Transparency masters are provided at the back of the unit.

Objectives:

Upon completion of this unit, the student will be able to:

1. Read a pesticide label.
2. Know the danger of various pesticides.
3. Understand how to dress for applying pesticides.
4. Know how to follow directions on a pesticide label.

Student Activities:

1. Read and understand sample pesticide labels.
2. Observe and practice with application equipment following safety procedures.
3. Read, answer and satisfactorily pass the exam for Private Pesticide Applicator Candidates.
4. If a land lab is available, students could practice pesticide application following all safety precautions and under the strict supervision of the instructor.
5. Set up trial plots and observe various rates of applications of pesticides and their degree of control.
6. Students will take and pass the State Applicators Licensing exam.

Introduction Ideas:

1. Introduce pesticides from the view point of weed free fields and pest free plants.
2. Invite a guest speaker from a local company that deals with pesticides.
3. Present a slide presentation on what effect pesticides make.

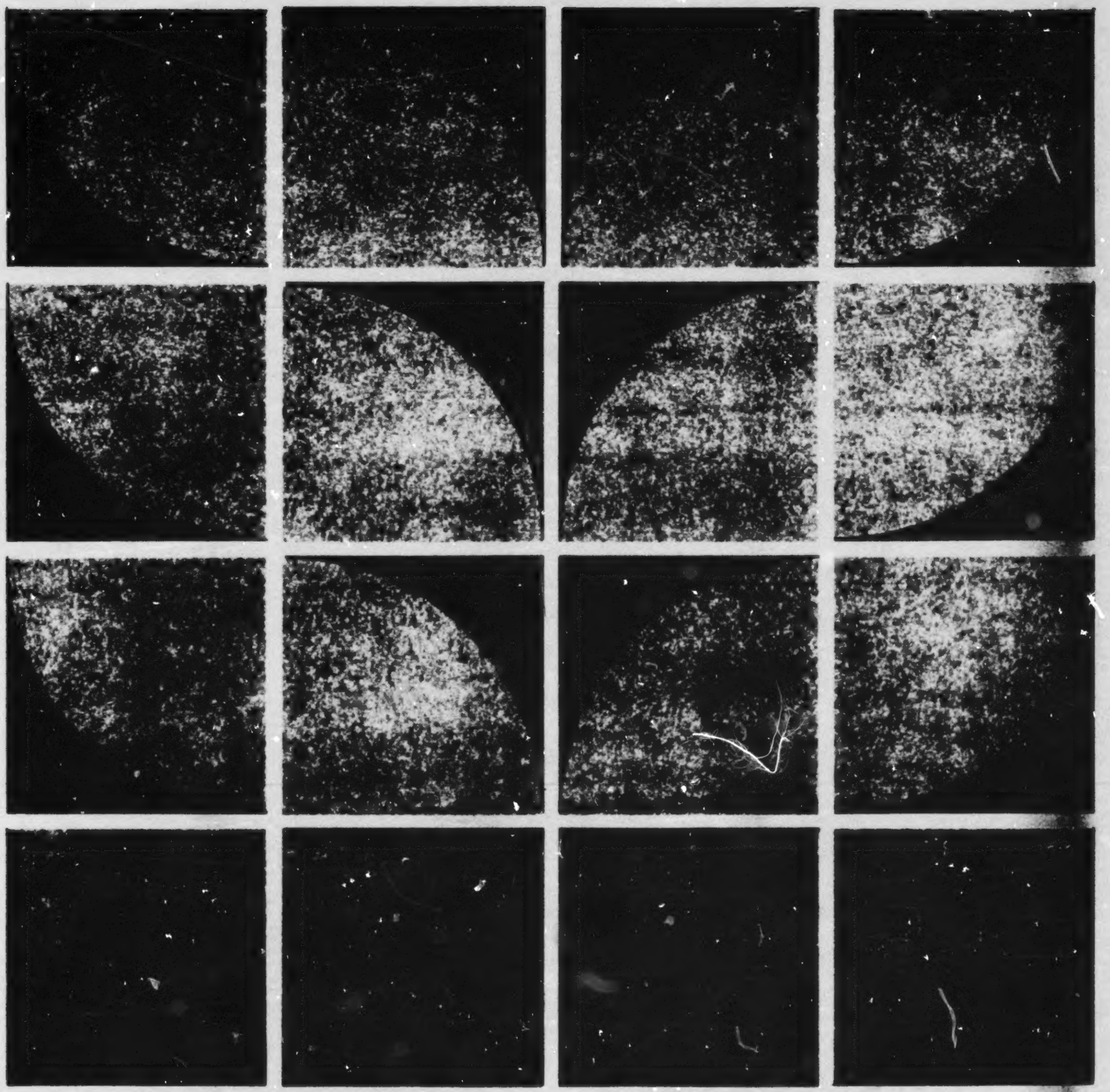
Ag IV - XII - 3

Apply Pesticides Correctly

A guide
for private
applicators

U.S. Department
of Agriculture

U.S. Environmental
Protection Agency



Apply Pesticides Correctly

A guide for private applicators

Contents

Preface ---------- iii
Introduction ---------- iii
Pests ---------- 1-1
  Insects ---------- 1-1
  Mites, Ticks, and Spiders ---------- 1-1
  Snails and Slugs ---------- 1-1
  Pest Animals ---------- 1-1
  Weeds ---------- 1-1
  Plant Diseases ---------- 1-2
Pest Control ---------- 1-2
Pesticides ---------- 2-1
  How Pesticides Work ---------- 2-1
  Using Pesticides ---------- 2-2
  Types of Formulations ---------- 2-2
Labels and Labeling ---------- 3-1
Using Pesticides Safely ---------- 4-1
  How Pesticides Harm Man ---------- 4-1
    Symptoms of Pesticide Poisoning ---------- 4-1
    First Aid Procedures ---------- 4-1
    Protecting Your Body ---------- 4-2
  How Pesticides Harm the Environment ---------- 4-3
  Safe Use Precautions ---------- 4-3
Application Equipment ---------- 5-1
  Sprayers ---------- 5-1
  Dusters and Granular Applicators ---------- 5-3
  Calibration ---------- 5-3
Laws and Regulations ---------- 6-1
  Federal Insecticide, Fungicide, and Rodenticide Act ---------- 6-1
  Residues ---------- 6-1

U.S. Environmental
Protection Agency

U.S. Department
of Agriculture

Preface

This guide has been developed by the Pesticide Operations Division, U.S. Environmental Protection Agency (EPA), and the Extension Service, U.S. Department of Agriculture (USDA).

The contributors are from State land-grant universities, other universities, USDA, EPA, and the pesticide industry. They include:

J. Blair Bailey, *University of California*,
Emerson Baker, *Environmental Protection Agency*,
John Boehle, Jr., *Ciba-Geigy Corporation*,
James J. Bonin, *Consultant*,
B. Jack Butler, *University of Illinois*,
James E. Dewey, *Cornell University*,
Burton R. Evans, *Environmental Protection Agency*,
William D. Fitzwater, *Environmental Protection Agency*,
L. C. Gibbs, *U.S. Department of Agriculture*,
Edward H. Glass, *New York Agricultural Experiment Station*,
Wayland J. Hayes, Jr., *Vanderbilt University*,
Fred W. Knapp, *University of Kentucky*,
John A. Lofgren, *University of Minnesota*,
Otis C. Maloy, *Washington State University*,
James F. Miller, *University of Georgia*,
Frank Murphey, *University of Delaware*,
Edward L. Nigh, Jr., *University of Arizona*,
Arthur Retan, *Washington State University*,
Harry K. Tayama, *The Ohio State University*.

Gerald T. Weekman, North Carolina State University, joint consultant for EPA and USDA, organized the project and served as editor. He was assisted by Mary Ann Wamsley, USDA.

Many other people contributed greatly to the book by reviewing it at various stages. They represent EPA, USDA, State regulatory agencies, the pesticide industry, environmental groups, and applicator associations.

Introduction

Federal regulations set minimum requirements that you must meet before you can use certain pesticides. This guide contains the practical information you need to prepare you to meet most of these requirements. It does not include all the things you need to know about the pests you wish to control. It may not include all the information you may be required to know to meet your State requirements. Your State Pesticide Regulatory Agency and your State Extension Service can give you this additional information.

This book will tell you:

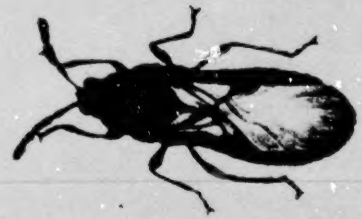
- some features of common pests, how they develop, and the kinds of damage they do,
- methods you can use to control pests,
- how pesticides work,
- how pesticide labels can help you,
- how to use pesticides so they will not harm you or the environment,
- how to choose, use, and care for some equipment, and
- the Federal laws that apply to your use of pesticides.

Pests

Pests can be put into five main groups:

- insects (plus mites, ticks, and spiders),
- snails and slugs,
- pest animals,
- weeds, and
- plant disease agents.

You probably will find some pests that you cannot identify. Never try to control a pest until you are sure of what it is. Ask your Cooperative Extension agent. He will help you to get the correct answer.



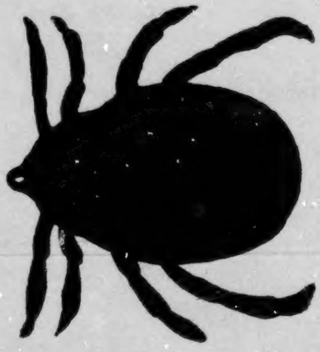
Insects

Many kinds of insects are pests. They may:

- feed on leaves,
- tunnel or bore in stems, stalks, and branches,
- feed on and tunnel in roots,
- feed on and in seeds and nuts,
- suck the sap from leaves, stems, roots, fruits, and flowers,
- carry plant and animal disease agents, and
- feed on or in man and other animals.

All adult insects have two things in common—they have six jointed legs and three body regions. Almost all insects change in shape, form, and size during their lives.

You can tell one insect from another by looking at the *wings* and *mouthparts*. Some insects have no wings. Others have two or four. The wings vary in shape, size, thickness, and structure. Insects feed in different ways. Those with chewing mouthparts have toothed jaws that bite and tear the food. Insects with piercing-sucking mouthparts have a long beak which they force into a plant or animal to suck out fluids or blood.



Mites, Ticks, and Spiders

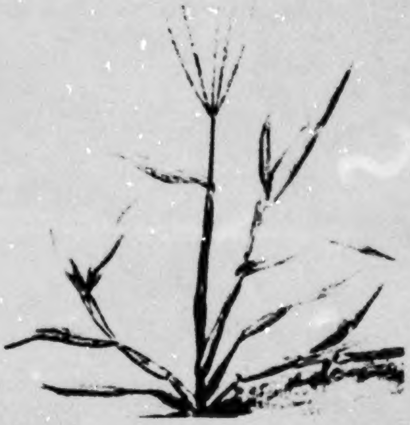
Mites, ticks, and spiders are closely related to insects. The main differences are that the adults have eight jointed legs instead of six and have two body regions. They do not have wings.

Snails and Slugs

Snails and slugs are members of a large group of animals called mollusks. Snails have a hard shell; slugs have no shell. They feed on plant foliage. They are pests in lawns, landscape plantings, and greenhouses.

Pest Animals

Fish, snakes, turtles, alligators, lizards, frogs, toads, salamanders, birds, and mammals may be pests. What may be a pest animal in some cases may be highly desirable in others.



Weeds

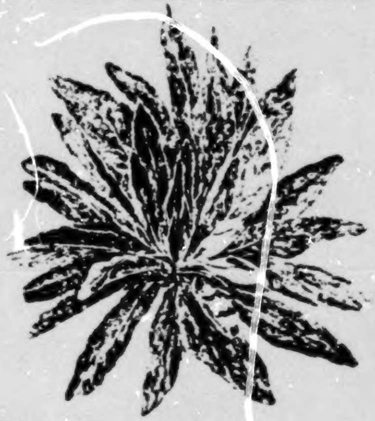
A weed is simply "a plant out of place." Before you can control weeds, you need to know something about how they grow. One important feature is the length of their life cycle.

Annuals

Plants with a one-year life cycle are *annuals*. They grow from seed, mature, and produce seed for the next generation in one year or less and then die.

Summer annuals are plants that result from seeds which sprout in the spring.

Winter annuals are plants that grow from seeds which sprout in the fall.

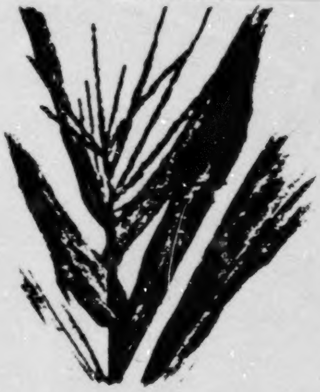


Biennials

Plants with a two-year life cycle are *biennials*. They grow from seed and develop a heavy root and a compact cluster of leaves the first year. In the second year they mature, produce seed, and die.

Perennials

Plants which live more than two years and may live indefinitely are *perennials*. During the winter many lose their foliage and the stems of others may die back to the ground. Some grow from seed. Others produce tubers, bulbs, rootlike below-ground stems or above-ground stems that produce roots.



Plant Diseases

A plant disease is any harmful condition that makes a plant different from a normal plant. There are two main kinds of plant diseases.

Diseases Caused by Non-Living Agents

The causes include such things as frost, air pollution, and drought. These diseases cannot be passed from one plant to another.

Diseases Caused by Living Things

The most common causes of these diseases and examples of the diseases they cause are:

- fungi (scabs and rot),
- bacteria (blights, wilts, and scabs),
- viruses (mosaics), and
- nematodes (root knots and cysts).

Some visible ways plants respond to disease causes are:

- galls, swellings, and leaf curls,
- stunting, lack of green color, and incomplete development of parts, and
- blights, leaf spots, wilting, and cankers.

Pest Control

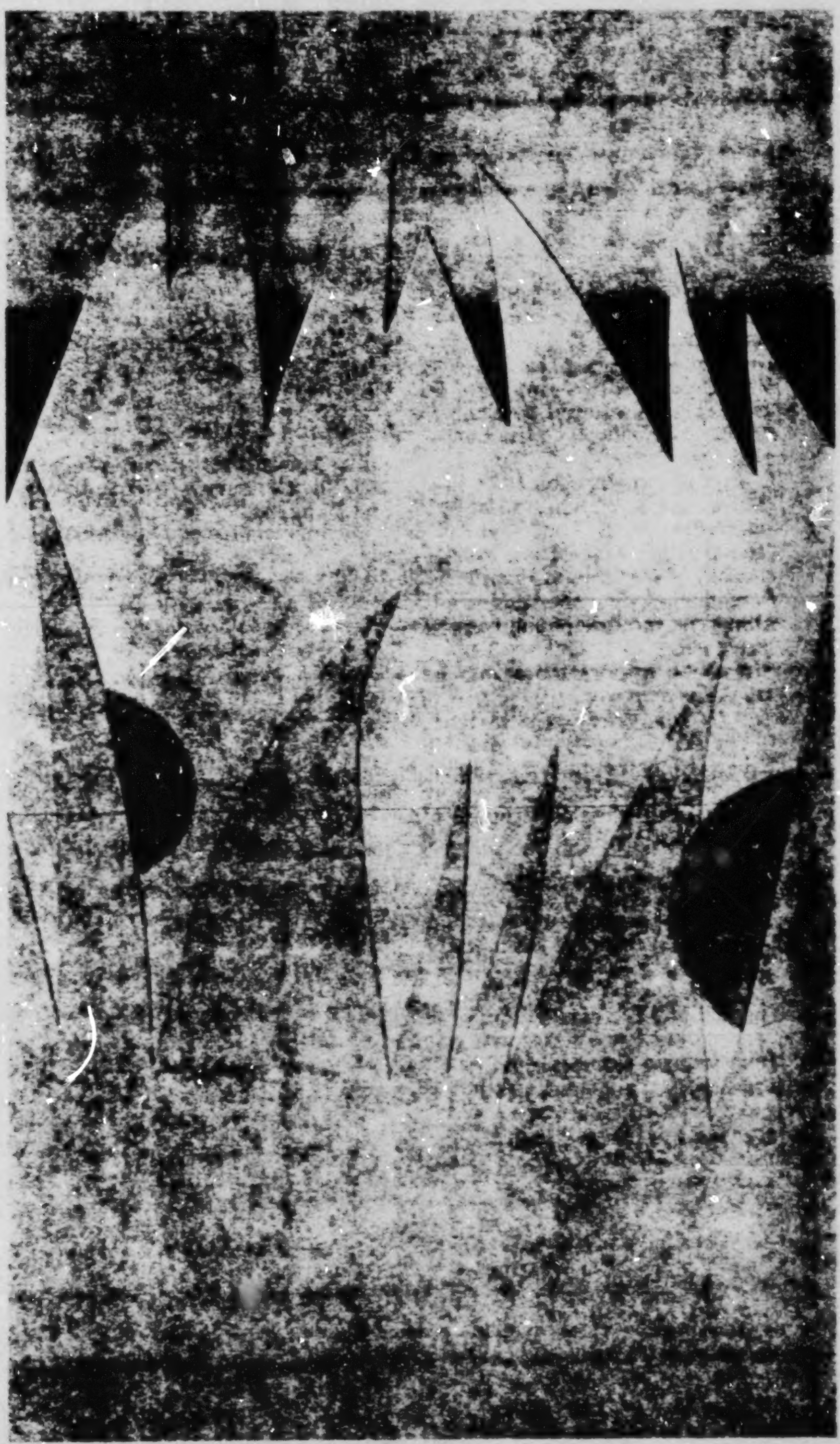
If you have identified a pest, and you know how it grows, spreads, and does its damage, you can begin to plan how to control it.

Using a pesticide is only one of many ways to control pests. The use of a combination of methods is basic to all pest control. Be sure to think about what other methods might work before you decide to apply a pesticide. You can minimize pest problems by:

- encouraging pests' natural enemies,
- planting crop varieties that resist pests,
- destroying crop residues,
- practicing good manure management,
- clean plowing and cultivation.

Pest control is necessary only when the pest is causing more damage than is reasonable to accept. Even though a pest is present, it may not do much harm. It could cost more to control the pest than would have been lost because of the pest's damage.

Pesticides



Here are the types and uses of pesticides:

Insecticide: controls insects and other related pests such as ticks and spiders.
Miticide: controls mites.
Acaricide: controls mites, ticks and spiders.
Nematicide: controls nematodes.
Fungicide: controls fungi.
Bactericide: controls bacteria.
Herbicide: controls weeds.
Rodenticide: controls rodents.
Avicide: controls birds.
Piscicide: controls fish.
Molluscicide: controls mollusks, such as slugs and snails.
Predacide: controls pest animals.
Repellent: keeps pests away.
Attractant: lures pests.
Plant Growth Regulator: stops, speeds up, or otherwise changes normal plant processes.
Desiccants and Defoliants: harvest-aid chemicals used to remove or kill leaves and stems.
Antitranspirant: Reduces water loss from plants.

How Pesticides Work

Pesticides can be grouped according to what they do. Many work in more than one way. Read the label to find out what the one you are using will do.

Some of the ways pesticides work are:
Contacts: kill pests simply by contacting them.
Stomach poisons: kill when swallowed.
Systemics: kill pests by being taken into the blood of the animal or sap of the plant upon which the pest is feeding.
Translocated herbicides: kill plants by being absorbed by leaves, stems, or roots and moving throughout the plant.
Fumigants: gases which kill

when they are inhaled or otherwise absorbed by the pest.
Selective: kills certain kinds of plants or animals.
Nonselective: kills most plants or animals.

Using Pesticides

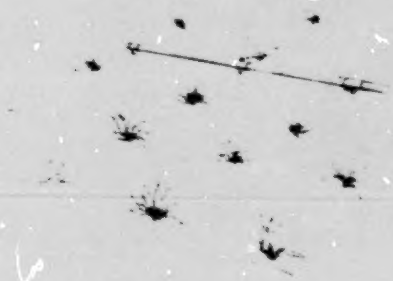
Many terms describe when and how to use pesticides.

When To Use

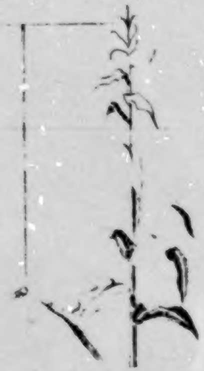
Preemergence: used before crops or weeds emerge. May also refer to use after crops emerge or are established, but before weeds emerge.
Preplant: used before the crop is planted.
Postemergence: used after the crop or weeds have emerged.

How To Use

Band: application to a strip over or along each crop row.



Broadcast: uniform application to an entire, specific area.
Dip: complete or partial immersion of a plant, animal, or object in a pesticide.



Directed: aiming the pesticide at a portion of a plant, animal, or structure.
Drench: saturating the soil with a pesticide; oral treatment of an animal with a liquid pesticide.
Foliar: application to the leaves of plants.
In-furrow: application to or in the furrow in which a plant is planted.
Over-the-top: application over the top of the growing crop.
Pour-on: pouring the pesticide along the midline of the back of livestock.
Sidedress: application along the side of a crop row.
Soil incorporation: application to the soil followed by use of tillage implements to mix the pesticide with the soil.
Spot treatment: application to a small area.

Types of Formulations

Active ingredients
(the chemicals that do the work)
+
Inert ingredients
(make the product easier to apply)
=
Pesticide formulation

Here are the most common kinds of formulations. Labeling and Cooperative Extension Service recommendations may refer to them by these common letter abbreviations.

Liquid Formulations

Emulsifiable Concentrates (EC or E)

An emulsifiable concentrate can be mixed with water to form an emulsion in your spray tank.

Ultra Low Volume Solutions (ULV)

These formulations may contain only the active ingredient itself. They require special application equipment.

Solutions (S)

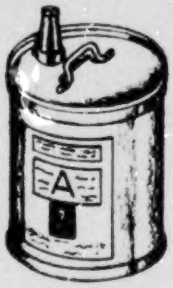
These formulations are ready to use. They are often used on livestock and in barns.

Flowables (F or L)

A flowable can be mixed with water to form a suspension in your spray tank.

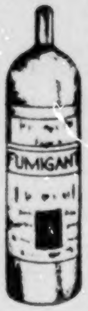
Aerosols (A)

These are low concentrate solutions, usually applied as a fine spray or mist indoors. Some are sold in pressurized cans.



Liquified Gases

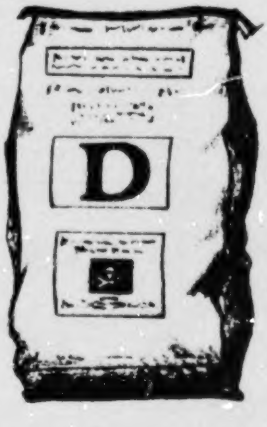
These fumigant formulations turn into a gas when they are applied. Some of them have to be packaged in pressure containers.



Dry Formulations

Dusts (D)

Dust formulations are made by adding the active ingredient to a fine inert powder. Dusts must be used dry.

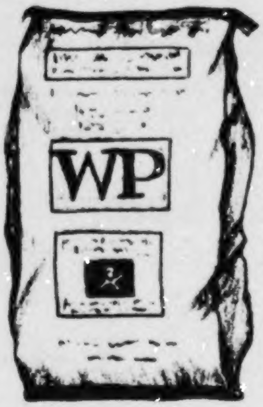


Granules (G)

Granular formulations are made by adding the active ingredient to coarse particles (granules) of some inert material. Granule particles are much larger than dust particles.

Wettable Powders (WP or W)

Wettable powder formulations are made by combining the active ingredient with a fine powder and a wetting agent. They look like dusts, but they are made to mix with water. These formulations need continuous agitation to maintain a suspension.

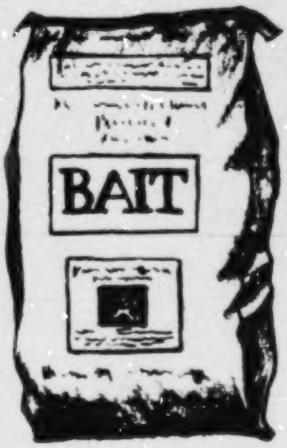


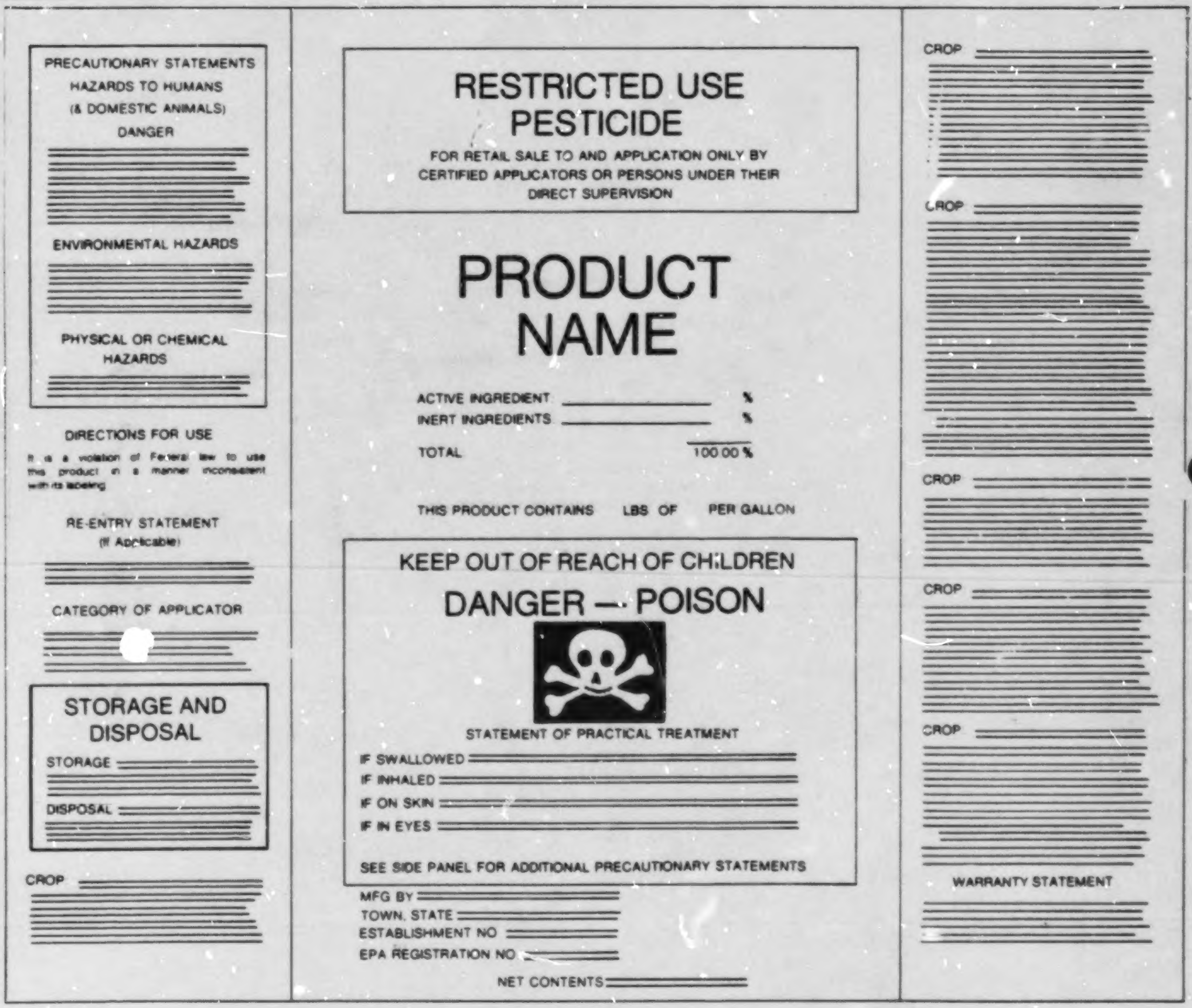
Soluble Powders (SP)

A soluble powder formulation is made from an active ingredient that dissolves in water.

Baits (B)

A bait formulation is made by adding the active ingredient to an edible or attractive substance.





PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS
(& DOMESTIC ANIMALS)
DANGER

ENVIRONMENTAL HAZARDS

PHYSICAL OR CHEMICAL HAZARDS

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

RE-ENTRY STATEMENT
(If Applicable)

CATEGORY OF APPLICATOR

STORAGE AND DISPOSAL

STORAGE

DISPOSAL

CROP

RESTRICTED USE PESTICIDE

FOR RETAIL SALE TO AND APPLICATION ONLY BY CERTIFIED APPLICATORS OR PERSONS UNDER THEIR DIRECT SUPERVISION

PRODUCT NAME

ACTIVE INGREDIENT ____________ %
INERT INGREDIENTS ____________ %
TOTAL 100.00 %

THIS PRODUCT CONTAINS LBS OF PER GALLON

KEEP OUT OF REACH OF CHILDREN

DANGER — POISON

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED
IF INHALED
IF ON SKIN
IF IN EYES

SEE SIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS

MFG BY
TOWN, STATE
ESTABLISHMENT NO
EPA REGISTRATION NO

NET CONTENTS

CROP

CROP

CROP

CROP

CROP

WARRANTY STATEMENT

Labels and Labeling

All the printed information you get about a pesticide product from the company or its agent is called labeling. Labeling includes such things as:

- the label on the product,
- brochures,
- flyers, and
- other printed information handed out by your dealer.

The label is the information printed on or attached to a container of pesticides. The label will tell you:

- how to use the product correctly, and
- what special safety measures you should take.

Parts of the Label

Brand Name

Each company uses brand names to identify its products. The brand name shows up plainly on the front panel of the label.

Type of Formulation

Different types of pesticide formulations (such as liquids, wettable powders, and dusts) require different methods of handling. The label will tell you what type of formulation the package contains. The same pesticide may be available in more than one formulation.

Ingredient Statement

Every pesticide label must list what is in the product. It tells you the names and amounts of the active ingredients and the amount of inert ingredients.

Common Name

Many pesticides have complex chemical names. Some have been given another name to make them easier to identify. These are called *common names*. A chemical made by more than one company will be sold under several brand names, but you may find the same common name or chemical name on all of them.

Net Contents

The net contents number tells you how much is in the container. This can be expressed in gallons, pints, pounds, quarts, or other units of measure.

Name and Address of Manufacturer

The law requires the maker or distributor of a product to put the name and address of the company on the label. This is so you will know who made or sold the product.

Registration Number

A registration number must be on every pesticide label. It shows that the product has been registered with the Federal Government.

Establishment Number

The establishment number tells what factory made the chemical. This number does not have to be on the label, but will be somewhere on each container.

Precautionary Statements

Hazards to Humans (and Domestic Animals)

This section will tell you the ways in which the product may be poisonous to man and animals. It also will tell you of any special steps you should take to avoid poisoning, such as the kind of protective equipment needed.

If the product is highly toxic, this section will inform physicians of the proper treatment for poisoning.

Environmental Hazards

The label tells you how to avoid hurting the environment. Some examples are:

- "This product is highly toxic to bees exposed to direct treatment or to residues on crops."
- "Do not contaminate water when cleaning equipment or when disposing of wastes."
- "Do not apply where runoff is likely to occur."

Physical and Chemical Hazards

This section will tell you of any special fire, explosion, or chemical hazards that the product may have.

BEST COPY AVAILABLE

Signal Words and Symbols

Some pesticides may be hazardous to people. You can tell how toxic a product is by reading the *signal word* and *symbol* on the label.

Signal Words

Signal Words	Toxicity	Appromixate Amount Needed To Kill the Average Person
DANGER	Highly toxic	a taste to a teaspoonful
WARNING	Moderately toxic	a teaspoonful to a tablespoonful
CAUTION	Low toxicity or Comparatively free from danger	an ounce to more than a pint

All products must bear the statement "Keep out of reach of children."

Symbol

The skull and crossbones is used on all highly toxic materials along with the signal word DANGER and the word POISON.

Statement of Practical Treatment

If swallowing or inhaling the product or getting it in your eyes or on your skin would be harmful, the label will tell you emergency first aid measures. It also will tell you what types of exposure require medical attention.

The pesticide label is the most important information you can take to the physician when someone has been poisoned.

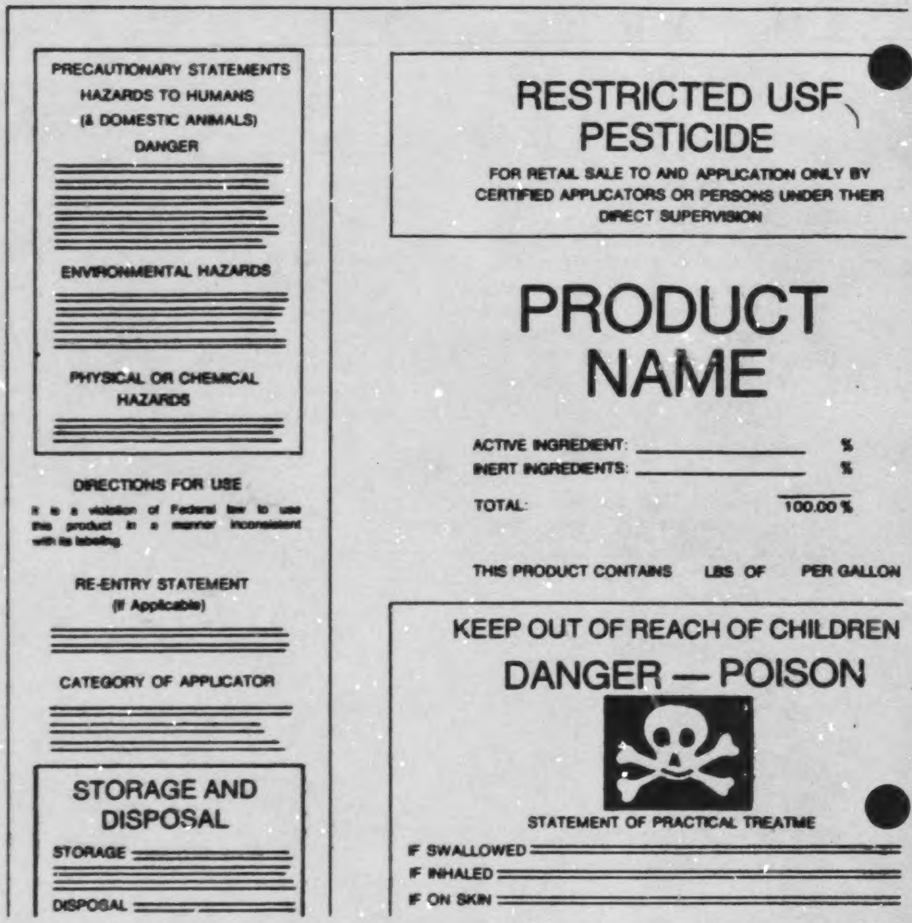
Statement of Use Classification

Every pesticide label must show whether the contents are for general use or restricted use. The label will say:

"General classification"

or

"Restricted use pesticide for retail sale to and application only by certified applicators or persons under their direct supervision."



PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS
(& DOMESTIC ANIMALS)
DANGER

ENVIRONMENTAL HAZARDS

PHYSICAL OR CHEMICAL HAZARDS

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

RE-ENTRY STATEMENT
(If Applicable)

CATEGORY OF APPLICATOR

STORAGE AND DISPOSAL
STORAGE
DISPOSAL

RESTRICTED USE PESTICIDE

FOR RETAIL SALE TO AND APPLICATION ONLY BY CERTIFIED APPLICATORS OR PERSONS UNDER THEIR DIRECT SUPERVISION

PRODUCT NAME

ACTIVE INGREDIENT: ______ %
INERT INGREDIENTS: ______ %
TOTAL: 100.00 %

THIS PRODUCT CONTAINS LBS OF PER GALLON

KEEP OUT OF REACH OF CHILDREN
DANGER — POISON

STATEMENT OF PRACTICAL TREATME
IF SWALLOWED
IF INHALED
IF ON SKIN

Directions for Use

The directions for use tell you:

- the pests the product will control (If you cannot find a product that lists the pest you want to control, ask your dealer or Cooperative Extension agent. The label may use a different name for the pest than the one you use.),
- the crop, animal, or other item the product can be used on,
- whether the product is for general or restricted use,
- how the product should be applied,
- how much to use,
- where the material should be applied, and
- when it should be applied.

Misuse Statement

This section will remind you that it is a violation of Federal law to use a product in a manner inconsistent with its labeling.

Reentry Statement

If required for the product, this section will tell you how much time must pass before a pesticide-treated area is safe for entry by a person without protective clothing. Consult local authorities for special rules that may apply.

Category of Applicator

If required for the product, this section will limit use to certain categories of commercial applicators.

Storage and Disposal Directions

Every pesticide should be stored and disposed of correctly. This section will tell you how to store and dispose of the product.

Do not use a product on a crop or for a pest not listed on the label. Always use it at the recommended rate.

Using Pesticides Safely

There are two good reasons for using pesticides safely:

- to keep yourself and other people from being poisoned, and
- to avoid harming the environment.

How Pesticides Harm Man

Most pesticides can cause severe illness, or even death, if misused. But every registered pesticide can be used safely if you use it correctly.

Many accidental pesticide deaths are caused by eating or drinking the product. But some applicators die or are injured when they breathe a pesticide vapor or get a pesticide on their skin. Repeated exposure to small amounts of some pesticides can cause sudden severe illness.

To prevent *all* accidents with pesticides you should:

- use and store pesticides away from children and other untrained persons,
- keep pesticides in their original containers, and
- take care to follow directions when using them.

Products for restricted use require special handling. The label is your guide.

Symptoms of Pesticide Poisoning

You should know the kinds of sickness that are caused by the pesticides you use.

Get medical advice quickly if you or any of your workers get sick during or after pesticide use. If you think a person may be poisoned, do not leave him alone. Do not let yourself or anyone else get dangerously sick before calling a physician or going to a hospital. Take the container (or the label) of the pesticide with you. Do not carry a pesticide container in the passenger space of a car or truck.

It is better to be too cautious than too late.

Parathion and Similar Pesticides

(Organophosphates and Carbamates)

These pesticides injure the nervous system. The symptoms develop in stages. They usually occur in this order:

Mild Poisoning

- fatigue
- headache
- dizziness
- blurred vision
- too much sweating and salivation
- nausea and vomiting
- stomach cramps or diarrhea

Moderate Poisoning

- unable to walk
- weakness
- chest discomfort
- muscle twitches
- constriction of pupil of the eye
- earlier symptoms become more severe

Severe Poisoning

- unconsciousness
- severe constriction of pupil of the eye
- muscle twitches
- secretions from mouth and nose
- breathing difficulty
- death if not treated.

Illness may occur a few hours after exposure. But if symptoms start more than 12 hours after you were exposed to the pesticide, you probably have some other illness. Check with your physician to be sure.

Several other pesticides may cause symptoms similar to these.

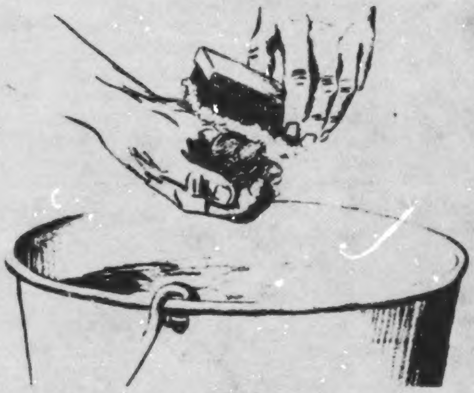
Fumigants and Solvents

Too much exposure to these chemicals may make a person appear drunk. The symptoms are:

- poor coordination,
- slurring words,
- confusion, and
- sleepiness.

First Aid Procedures

Read the "Statement of Practical Treatment" on each label. The directions listed can save your life and the lives of your family and your workers.



If you get a pesticide on your skin:

- Remove the pesticide as quickly as possible. Remove all contaminated clothing. Prompt washing may prevent sickness even when the spill is very large. Detergents work better than soap in removing pesticides. Don't forget your hair and fingernails.

If you inhale a pesticide:

- Get to fresh air right away.

If you splash a pesticide into your mouth or swallow it:

- Rinse your mouth with several glasses of water.
- Go or be taken to a physician immediately.
- It is sometimes dangerous to cause vomiting; follow label directions.

If a person has been poisoned, do not leave him alone.

In addition, remember to bathe, using a detergent, when you finish working with pesticides or pesticide-contaminated equipment. Any time you spill a pesticide on yourself, wash immediately.

Protecting Your Body

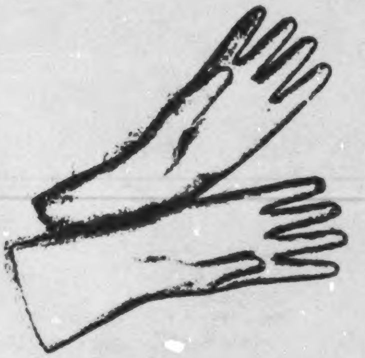
The label of each pesticide you use will tell you the kind of protection you need.

Protective Clothing

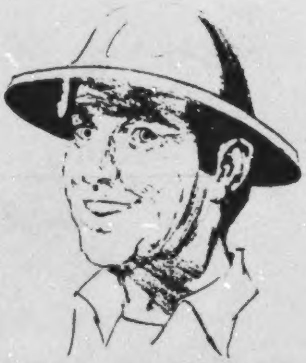
Body Covering—In general, any time you handle pesticides, you should wear:

- a long-sleeved shirt and long-legged trousers, or
- a coverall type garment.

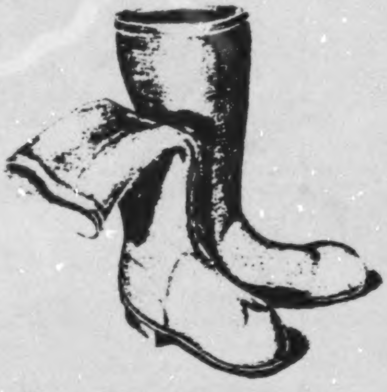
Clothing should be made of closely woven fabric. When you handle pesticide concentrates or very toxic materials, also wear a liquid-proof raincoat or apron. Trousers should be *outside* of the boots to keep pesticides from getting inside.



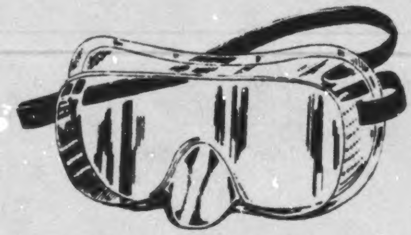
Gloves—Gloves should be long enough to protect your wrist. They should be made of neoprene and not lined with a fabric. Never use cotton or leather gloves unless the label tells you to. Sleeves should be *outside* of the gloves to keep pesticides from running down the sleeves and into the gloves.



Hat—Always wear something to protect your head. A wide-brimmed, waterproof hat will help protect your head, neck, eyes, mouth, and face. Wide-brimmed plastic "hard hats" are good. They are waterproof and easy to clean and are cool in hot weather. A plastic sweatband is best.



Boots—Wear unlined neoprene boots. Do not use leather or canvas boots unless the label tells you to.



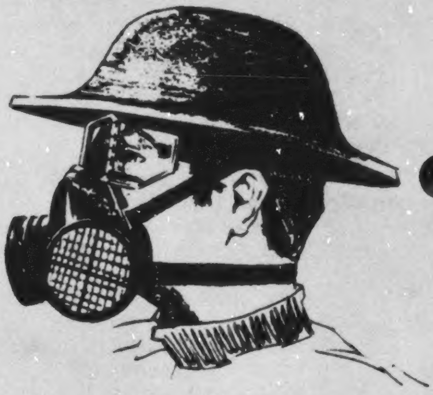
Goggles or Face Shield—Wear goggles or a face shield when handling pesticides to avoid getting pesticides in your eyes.

Care of Clothing—Wear clean clothing daily. If clothes get wet with spray, change them right away. If they get wet with pesticide concentrates or highly toxic pesticides, destroy them. They are hard to get clean in normal home laundering. Never store or wash pesticide contaminated clothing with the family laundry. Wash hats, gloves, and boots daily. Test gloves for leaks by filling them with water and gently squeezing.

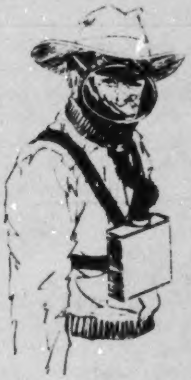
Wash goggles or face shields at least once a day. Elastic fabric headbands absorb pesticides. Use neoprene headbands.

Respiratory Protective Devices

You *must* wear an approved respiratory device when the label directs you to do so. Follow the label instructions on respiratory protection.



Chemical Cartridge Respirators—These half-face masks cover the mouth and nose.



Chemical Canister Respirators (Gas Masks)— Canister respirators cover your face. When correctly fitted they protect the face better than cartridge respirators.

Do not use either cartridge or canister respirators for protection during space fumigation or when the oxygen supply is low. Use special breathing devices as directed on the label.

Selection and Maintenance— Be sure you choose a respirator that is made to protect against the pesticides you use. Use only those approved by the National Institute for Occupational Safety and Health (NIOSH) or the Mining Enforcement and Safety Administration (MESA).

The respirator you choose must fit your face. Long sideburns, a beard, or glasses can prevent a good seal.

Read the manufacturer's instructions on the use and care of any respirator and its parts before you use it.

When applying pesticides, change cartridges and canisters if you have trouble breathing or if you smell pesticides. After use, remove and dispose of them as you would excess pesticides. Wash the face piece with detergent and water, rinse it, and dry it with a clean cloth after each use. Store your respirator in a clean, dry place away from pesticides. If you have trouble breathing while wearing a respirator, see your physician to find out if you have a respiratory problem.

How Pesticides Harm the Environment

Here are some ways damage can occur.

Direct Kill

Fine mists of herbicide can drift to nearby crops or landscape plants and kill them. You can kill bees and other pollinators if you treat a crop with a pesticide while they are in the field. Or you could kill the natural enemies of pest insects.

Life in streams or ponds can be wiped out by:

- accidental spraying of ditches and waterways.
- runoff from sprayed fields,
- careless tank filling or draining, or
- careless container disposal.

If more than one pesticide will control the pest, choose the one that is the least hazardous to the environment and most useful for your situation. Ask your Cooperative Extension agent to help you make this choice.

Persistence and Accumulation

Not all pesticides act the same after you apply them. Most are in one of these two groups:

Pesticides that break down quickly remain in the environment only a short time before being changed into harmless products.

Pesticides that break down slowly may stay in the environment without change for a long time. They are called *persistent pesticides.*

Some persistent pesticides can build up in the bodies of animals, including man. These pesticides are called *accumulative.*

Pesticide Movement in the Environment

Pesticides become problems when they move off target. This may mean:

- drifting out of the target area in the form of dust or mist,
- moving on soil particles by erosion,
- leaching through the soil,
- being carried out as residues in crops and livestock, or
- evaporating and moving with air currents.

Safe Use Precautions

You can prevent harm from pesticides if you follow safety precautions and use common sense. Here are the *minimum* safety steps you should take.

Before You Buy a Pesticide

The first and most important step in choosing a pesticide is to know what pest you need to control. Then find out which pesticides will control it. You may have a choice of several. Ask your dealer or Cooperative Extension agent to help you.

At the Time of Purchase

Read the label of the pesticide you intend to buy to find out:

- restrictions on use,
- if this is the correct chemical for your problem,
- if the product can be used safely under your conditions,
- environmental precautions needed,
- if the formulation and amount of active ingredient are right for your job,
- if you have the right equipment to apply the pesticide,
- if you have the right protective clothing and equipment, and
- how much pesticide you need.

Before You Apply the Pesticide

Read the label again to find out:

- the protective equipment needed to handle the pesticide,
- the specific warnings and precautions,
- what it can be mixed with,
- how to mix it,
- how much to use,
- safety measures,
- when to apply to control the pest and to avoid illegal residues,
- how to apply,
- the rate of application, and
- special instructions.

Transportation of Pesticides

You are responsible for the safe transport of your pesticide.

- The safest way to carry pesticides is in the back of a truck. Fasten down all containers to prevent breakage and spillage.
- Keep pesticides away from food, feed, and passengers.

- Pesticides should be in their original labeled packages. Keep paper and cardboard packages dry.
- If any pesticide is spilled in or from the vehicle, clean it up right away. Use the correct cleanup method.
- Do not leave unlocked pesticides unattended. You are responsible if accidents occur.

Pesticide Storage

The label will tell you how to store the product.

The storage place should keep the pesticides dry, cool, and out of direct sunlight.

The storage place should have:

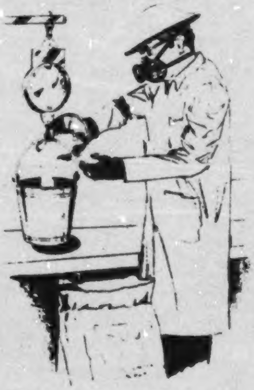
- fire-resistant construction, including a cement floor,
- an exhaust fan for ventilation,
- good lighting, and
- a lock on the door.

Keep the door locked when the building is not in use.

Store all pesticides in the original labeled containers.

Do not store them with food, feed, seed, or animals.

Check every container often for leaks or breaks. If one is damaged, transfer the contents to a container that has held *exactly* the same pesticide. Clean up any spills. Use correct cleanup methods.



Mixing and Loading Pesticides

Keep livestock, pets, and people out of the mixing and loading area.

Work outdoors. Do not work alone. Choose a place with good light and ventilation. Do not mix or load pesticides indoors or at night unless there is good lighting and ventilation.

Before handling a pesticide container, put on the correct protective clothing and equipment.

Each time you use a pesticide, read the directions for mixing. Do this before you open the container. *This is essential.* Directions, including amounts and methods, may have changed since you last used the product.

When taking a pesticide out of the container, keep the container and pesticide below eye level. This will avoid a splash or spill on your goggles or protective clothing.

If you splash or spill a pesticide while mixing or loading:

- stop right away.
- remove contaminated clothing.
- wash thoroughly with detergent and water. *Speed is essential.*
- use correct cleanup methods to clean up the spill.

When mixing pesticides, measure carefully. Use only the amount called for on the label. Mix only the amount you plan to use.

When loading pesticides, stand so the wind blows across your body from the right or left to avoid contaminating yourself.

To prevent spills, replace all pour caps and close containers after use.

Pesticide Application

Wear the protective clothing and equipment the label requires.

To prevent spillage of chemicals, check all application equipment for:

- leaking hoses, pumps or connections, and
- plugged, worn, or dripping nozzles.

Use water to calibrate your spray equipment before use.

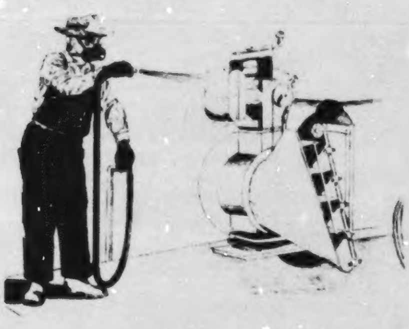
Before starting a field application, clear all livestock and people from the area to be treated.

Drift is the movement of spray droplets or dust particles away from the target area. To minimize drift, apply pesticides only on days with light breezes. If moderate to strong winds come up while you are working, stop immediately.

You also can reduce drift by spraying at the lowest practical pressure and using the largest practical nozzle openings for the job you are doing.

Vaporization is the evaporation of an active ingredient during or after application. Pesticide vapors can cause injury far from the site of application. High temperatures increase vaporization. You can reduce vaporization by:

- choosing pesticide formulations that do not evaporate easily, and
- spraying in the cooler parts of the day.



Cleaning Equipment

Mixing, loading, and application equipment must be cleaned as soon as you finish using it. Clean both the inside and outside. Wear the protective clothing you would wear for mixing pesticides.

Take special care if you must make equipment repairs before the equipment is completely cleaned.

Have a special area for cleaning. It is best for the area to have a wash rack or concrete apron with a good sump. This will catch all contaminated wash water and pesticides. Dispose of sump wastes by burning or burial as you would excess pesticides. Keep drainage out of water supplies and streams.

Disposal

Excess Pesticides

If you have excess diluted pesticides or pesticides in their original containers:

- Use them up according to label directions; if you cannot,
- bury them in a special landfill or store them until you can.

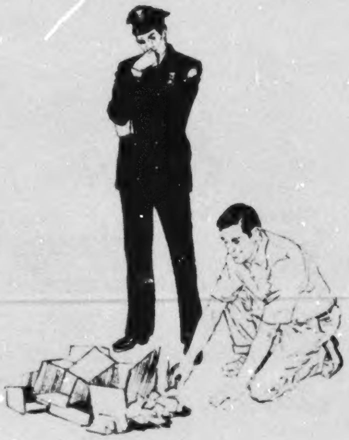
Empty Containers

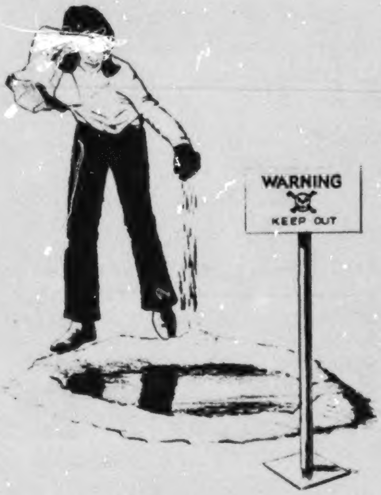
Rinse and drain all metal, plastic, or glass containers this way:

1—Empty the container into the tank. Let it drain an extra 30 seconds.
2—Fill it one-fifth to one-fourth full of water.
3—Replace and tighten the closure and shake the container. Upend the container so the rinse reaches all the inside surfaces.
4—Drain the rinse water from the container into the tank. Let the container drain for 30 seconds after emptying.
5—Repeat steps 2, 3, and 4 two more times.

You can bury rinsed containers singly in open fields. Puncture or break the containers before burying them. Bury them at least 18 inches below the surface where they will not pollute surface or subsurface water. Or you can dispose of empty rinsed containers in a sanitary landfill. Check state and local regulations.

You may burn small numbers of paper containers in open fields. Stay out of fumes and smoke. Be sure your state and local regulations permit open burning.





Cleanup of Spills

Keep people away from spilled chemicals.

If the pesticide was spilled on anyone, give the correct first aid.

Confine the spill. Dike it up with sand or soil if necessary.

Use an absorbent material to soak up the spill. You can use soil, sawdust, or a special product made to do this. Shovel all contaminated material into a leakproof container for disposal. Dispose of it in a special landfill.

If the spill is on a state highway, call the highway patrol.

If the spill is on a county road or a city street, call the county sheriff or city police.

If water is contaminated, notify your county health officials.

Safe Entry Times

It may be dangerous for an unprotected person to enter an area immediately after some pesticides have been used. The time that must pass before the area is safe for a person without protective clothing is called a safe-entry time, or reentry period. This time is given on the label of each pesticide that may cause a reentry problem. Reentry may pose special problems in some areas. Check with local authorities for any special rules that may apply.

Application Equipment

The pesticide application equipment you use is important to the success of your pest control job. You must first select the right kind of equipment. Then you must use it correctly to suit your needs and take good care of it. Here are some things you should know about choosing, using, and caring for equipment.

Sprayers

Hand Sprayers

Hand sprayers are for small jobs around the farm and home. You can use them in restricted areas where a power sprayer would not work.

Advantages:

- economical,
- simple, and
- easy to use, clean, and store.

Limitations:

- may give an uneven application rate because of hand operation, and
- lack agitation and screening for using wettable powder formulations. You must shake the sprayer often to provide agitation.

Low Pressure Field Sprayers

Most of these sprayers are used for treating field and forage crops, pastures, and fence rows. They also may be used to apply fertilizer-pesticide mixtures.

Advantages

- medium to large tanks,
- low cost,
- light weight, and
- versatility.

Limitations

- low gallonage output limits their use when high volume is needed,
- low pressure limits pesticide penetration, and
- agitation is limited.

High Pressure Sprayers

These are often called hydraulic sprayers. They are designed to deliver high volumes (100 or more gallons per acre) at high pressure (above 100 psi). They are used to spray fruits, vegetables, landscape plants, and livestock.

Advantages:

- well built,
- usually have mechanical agitation,
- durable.

Limitations:

- high cost,
- large amounts of water, power, and fuel needed,
- high tire loads, and
- high pressure which makes a spray that drifts easily.

Air Blast Sprayers

These units use a high speed airstream to break up the nozzle output into fine drops which move with the airstream to the target. The air is directed to either one or both sides as the sprayer moves forward.

Advantages:

- good coverage and penetration,
- low pump pressures, and
- mechanical agitation.

Limitations:

- drift hazards,
- chance of overdosages,
- difficult to use in small areas, and
- hard to confine spray discharge to specific target.

Ultra Low Volume (ULV) Sprayers

Deliver undiluted special pesticide formulations. High speed airstreams may be used to break up and direct the spray.

Advantages:

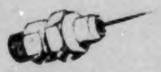
- no water is needed, and
- equal control with less pesticide.

Limitations:

- does not provide for thorough wetting,
- hazards of using high concentrates,
- chance of overdosage, and
- small number of pesticides that can be used this way.

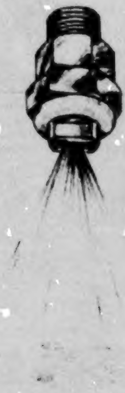
Nozzles

There are five basic nozzle types. All other types are variations. They are:

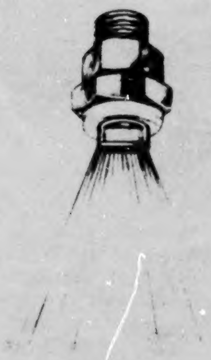


Solid Stream—A single jet used in handguns to spray a distant target or fixed in a nozzle body to apply a narrow band or to inject into the soil.

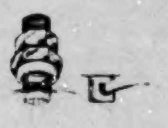
Flat Fan—This type has three different variations:



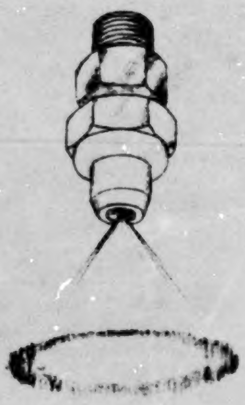
- The regular flat fan nozzle makes a narrow oval pattern with lighter edges. It is used on booms for broadcast spraying and is designed to be overlapped 30-50 percent for even distribution.



- The even flat fan nozzle makes a uniform pattern across its width. It is used for band spraying and for spraying walls and other surfaces.

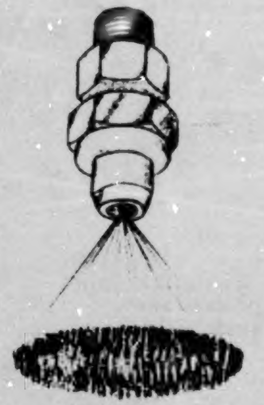


- The flooding nozzle makes a wide-angle flat spray pattern. It works at lower pressures than the other flat fan nozzles. Its pattern is fairly uniform across its width. It is used for broadcast spraying.

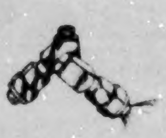


Hollow Cone—This nozzle forms a pattern that is circular with tapered edges and little or no spray in the center. It is used for spraying foliage. There are two types of hollow cone nozzles:

- the core and disk, and
- the whirl chamber.



Solid Cone—This nozzle forms a circular pattern. The spray is well-distributed throughout the pattern. It is used for spraying foliage.



Broadcast—This nozzle forms a wide flat fan pattern. It is used on boomless sprayers and to extend the effective swath width when attached to the end of a boom.

You can get nozzles in many materials. Here are the main features of each kind.

Brass:
- Inexpensive,
- Wears quickly from abrasion,
- Probably the best material for limited use.

Stainless Steel:
- Will not corrode,
- Resists abrasion, especially if it is hardened,
- Probably the best material for extensive use.

Plastic:
- Resists corrosion and abrasion,
- Swells when exposed to some solvents.

Aluminum:
- Resists some corrosive materials,
- Is easily corroded by some fertilizers.

Tungsten Carbide and Ceramic:
- Highly resistant to abrasion and corrosion,
- Expensive.

Use and Care of Nozzles

Use nozzles of uniform type and size. Nozzle caps should not be overtightened. Adjust nozzle height and spacing to suit the target. Follow the nozzle manufacturer's instructions and the directions on the pesticide label.

Replace any nozzles having faulty spray patterns.

Check each nozzle for uniform flow using water and a jar marked in ounces. Replace any with flow 5 percent more or less than the average of the nozzles in the system.

Clean nozzles only with a toothbrush or wooden toothpick.

Operation and Maintenance

Always read and follow the operator's manual. It will tell you how to use and care for your sprayer. Always drain and rinse your sprayer after each use. Check for leaks before and during use. Be alert for nozzle clogging and changes in nozzle patterns.

If nozzles clog or other trouble occurs in the field, shut off the sprayer and move it to the edge of the field before dismounting to correct the problem. Wear protective clothing while making repairs.

Store sprayers properly after use. But first, rinse and clean the system. Then fill the tank almost full with clean water. Add a small amount of new light oil to the tank. Coat the system by pumping tank contents out through the nozzles. Drain the pump and plug its openings or fill the pump with light oil or antifreeze. Remove nozzles and nozzle screens and store in light oil or diesel fuel.

Dusters and Granular Applicators

Hand Dusters

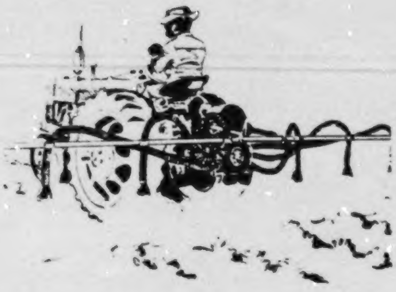
Like hand sprayers, hand dusters are used mainly around homes and in gardens. They may consist of a squeeze tube or shaker, a sliding tube, or a fan powered by a hand crank.

Advantage:

- the pesticide is ready to apply.

Limitations:

- high cost for pesticide,
- hard to get good foliar coverage, and
- dust is subject to drifting.



Power Dusters

Power dusters use a powered fan or blower to propel the dust to the target. They range from knapsack types to those mounted on or pulled by tractors.

Advantages:

- simply built,
- easy to maintain, and
- low in cost.

Limitations:

- drift hazards,
- high cost of pesticide, and
- application may be less uniform than sprays.

Granular Applicators

These include:

- hand-carried spinning disk types for broadcast coverage,
- mounted equipment for applying bands over the row in row crops, and
- mounted or tractor-drawn machines for broadcast coverage.

Advantages:

- eliminates mixing,
- is low in cost, and
- minimizes drift.

Limitations:

- high cost for pesticide,
- limited use against some pests because granules won't stick to most plants.

Use and Maintenance

Dusters and granular applicators are speed-sensitive, so maintain uniform speed. Do not travel too fast for ground conditions. Bouncing equipment will cause the application rate to vary. Stay out of any dust cloud that may form.

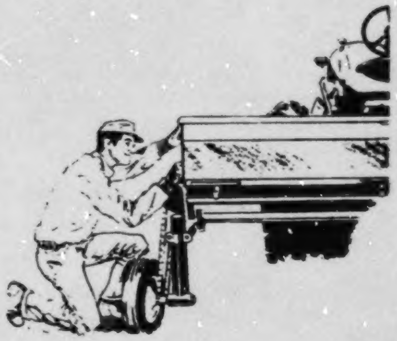
Watch banders to see that band width stays the same. Small height changes due to changing soil conditions may cause rapid changes in band width.

Clean equipment as directed by the operator's manual.

Calibration

Calibration is simply adjusting your equipment to apply the desired rate of pesticide. You need to do this so that you can be sure you are using each pesticide as directed on the label. Too much pesticide is dangerous; too little will not do a good job. Only by calibrating correctly can you safely get the best results.

There are many ways to calibrate equipment. The preferred methods differ according to the kind of equipment used. Your Cooperative Extension agent can show you how to calibrate your equipment. Here is one basic method for sprayers and another for dusters and granular applicators.



Sprayers

To apply a pesticide evenly and accurately, your sprayer must move at a constant speed when in use. It also must be pumping at a constant pressure. Each nozzle must be clean and at the right height. All nozzles must be of the correct type and size. Each nozzle in the system must deliver its rated amount of pesticide.

First, choose the speed, pumping pressure, and nozzles that you want to use. Fill the spray tank with water and operate the sprayer in place to fill the system. Then top off the tank. Spray one acre as if you were applying the pesticide. Measure the amount of water needed to refill your tank. This is your application rate per acre. If it takes 8 gallons to refill the tank, you are spraying at the rate of 8 gallons per acre. If your sprayer has a tank of more than 10 gallons capacity, spray an area large enough to use at least 10 percent of the tank capacity.

If your sprayer is delivering more or less spray than the label directs, you can change the rate three ways:

- You can change the pressure. Lower pressure means less spray delivered; higher pressure means more spray delivered. Pressure change may change the nozzle pattern and droplet size. Pressure must be increased 4 times to double the output.
- You can change the speed of your sprayer. Slower speed means more spray delivered; faster speed means less spray delivered. If you drive half as fast, you double the delivery rate.
- You can change the nozzle tips to change the amount delivered. The larger the hole in the tip, the more spray delivered. This is the best method for making major changes in the delivery rate of sprayers. Always select nozzles for the job you want done. Use the manufacturer's performance charts to make your selection.

After making a pressure, speed, or nozzle change, recalibrate your sprayer to measure its delivery rate.

You now know how many gallons of spray per acre your equipment will apply. Next you must find out how much pesticide to put in the tank to apply the correct dosage of pesticide. To do this you need to know two more facts:

- How much your sprayer tank holds.
- The amount of formulation to be used per acre; this will be listed on the label.

Suppose your tank holds 50 gallons of spray. The directions say to apply one pint of formulation on each acre. In our example, you found that your sprayer applies 8 gallons per acre. First find the number of acres one tank load will spray. Divide 50 gallons by 8.

$$\frac{\textit{50 gallons per tankful}}{\textit{8 gallons per acre}} = \textit{6}\tfrac{1}{4}\textit{ acres per tankful}$$

Then find the amount of formulation you must add to your tank so you can spray 6¼ acres with one pint per acre. Multiply 1 pint by 6¼.

1 pint per acre × 6¼ acres per tankful
= 6¼ pints per tankful.

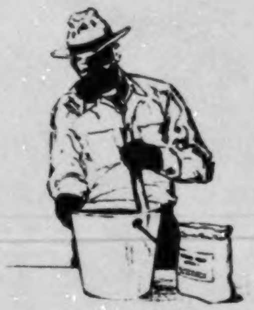
Suppose the formulation of a pesticide is a 50 percent wettable powder and you want to apply ½ pound of active ingredient per acre. In our example your tank covers 6¼ acres.

Find how many pounds of formulation are needed to apply ½ pound of active ingredient per acre. There is ½ pound of active ingredient in 1 pound of 50 percent wettable powder formulation.

So you need to use 1 pound of formulation for each acre your sprayer will cover.

1 pound per acre × 6¼ acres per tankful
= 6¼ pounds per tankful.

You should add the 6¼ pounds of wettable powder to a small amount of water in a clean bucket. Stir until it is mixed well and then add this mixture (called a slurry) to the partly filled tank. Remember to operate the sprayer's agitator while adding the mixture and filling the tank.

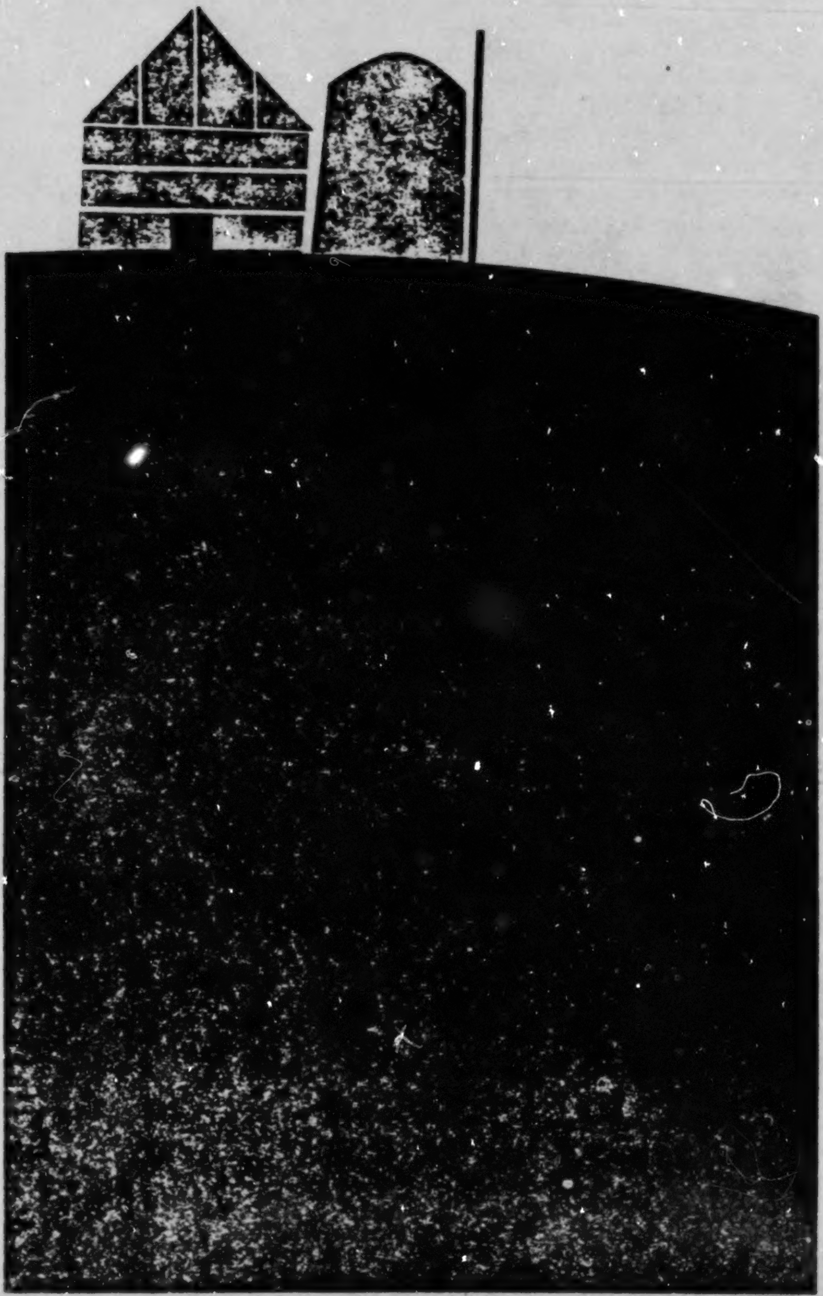


Even after your sprayer is calibrated, you should recheck it often. Be sure you are spraying the same area for each tankful as you figured on. If you are spraying more or less area than you planned, stop spraying and recalibrate. If you have figured wrong or your sprayer delivery rate changes, you will be able to catch it before you make a major mistake.

Dusters and Granular Applicators

- Read the manufacturer's operator's manual. Follow these instructions to set the gate openings for the product you are going to use.
  Caution: Always set the openings from the same direction, such as from closed to open. This will minimize variations in settings.
- Fill each hopper to an easily determined level.
- Operate the equipment over a measured area or distance at your normal working speed. The area should be at least ¼ acre or 1,000 feet of row.
- Refill the hopper to the same level, carefully weighing the amount of pesticide needed.
- The amount of pesticide it takes to refill the hopper is the amount applied to the measured area or distance. If the amount applied does not fall within 5 percent of the recommended dosage, reset the gate openings and repeat the previous three steps.
- Keep a record of the acreage treated with each filling of the hopper. This will let you see any slight change in rate of application and make the necessary adjustments.

Laws and Regulations



Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as Amended

This is the law which requires you to show that you know the correct way to use and handle pesticides. Here are the parts of the law which concern you:

- It says that all pesticide uses must be *classified* as either general or restricted,
- It requires you to be *certified* as competent to use any of the pesticides classified for restricted use, and
- It provides *penalties* (up to $1,000 and 30 days in prison) for people who do not obey the law.

Residues

The pesticide that stays in or on raw farm products is called a *residue*. The Federal Food, Drug, and Cosmetic Act gives EPA the authority to say what amounts of residue are safe. These amounts are called *tolerances*.

Tolerances are expressed in "parts per million" (ppm). One ppm equals one part (by weight) of pesticide for each million parts of the farm product. Using pounds as a measure, 50 ppm would be 50 pounds of pesticide in a million pounds of the product. The same pesticide may have a different tolerance on different products.

Label instructions take these things into account. They will tell you how many days before harvest the pesticide may be applied. Follow the label exactly.

Other Terms Used in Pest Control

Some of these words have several meanings. Those given here are the ones that relate to pest control.

Abrasion: The process of wearing away by rubbing.

Abscission: The separation of fruit, leaves, or stems from a plant.

Absorption: The process by which a chemical is taken into plants, animals, or minerals. Compare with *adsorption*.

Activator: A chemical added to a pesticide to increase its activity.

Adherence: Sticking to a surface.

Adjuvant: Inert ingredient added to a pesticide formulation to make it work better.

Adsorption: The process by which chemicals are held on the surface of a mineral or soil particle. Compare with *absorption*.

Adulterated: Any pesticide whose strength or purity falls below the quality stated on its label. Also, a food, feed, or product that contains illegal pesticide residues.

Aerobic: Living in air. The opposite of anaerobic.

Aerosol: An extremely fine mist or fog consisting of solid or liquid particles suspended in air. Also, certain formulations used to produce a fine mist.

Agitation: The process of stirring or mixing in a sprayer.

Alkaloids: Chemicals present in some plants. Some are used as pesticides.

Anaerobic: Living in the absence of air. The opposite of aerobic.

Animal Sign: The evidences of an animal's presence in an area.

Antagonism: The loss of activity of a chemical when exposed to another chemical.

Antibiotic: A substance which is used to control pest microorganisms.

Antidote: A practical treatment for poisoning, including first aid.

Aqueous: A term used to indicate the presence of water in a solution.

Arsenicals: Pesticides containing arsenic.

Aseptic: Free of disease-causing organisms.

Bait Shyness: The tendency for rodents, birds, or other pests to avoid a poisoned bait.

Bipyridyliums: A group of synthetic organic pesticides which includes the herbicide paraquat.

Botanical Pesticide: A pesticide made from plants. Also called plant-derived pesticides.

Broadleaf Weeds: Plants with broad, rounded, or flattened leaves.

Brush Control: Control of woody plants.

Carbamate: A synthetic organic pesticide containing carbon, hydrogen, nitrogen, and sulfur.

Carcinogenic: Can cause cancer.

Carrier: The inert liquid or solid material added to an active ingredient to prepare a pesticide formulation.

Causal Organism: The organism (pathogen) that produces a specific disease.

Chemosterilant: A chemical that can prevent reproduction.

Chlorinated Hydrocarbon: A synthetic organic pesticide that contains chlorine, carbon, and hydrogen. Same as organochlorine.

Chlorosis: The yellowing of a plant's green tissue.

Cholinesterase: A chemical catalyst (enzyme) found in animals that helps regulate the activity of nerve impulses.

Compatible: When two or more chemicals can be mixed without affecting each other's properties, they are said to be compatible.

Concentration: The amount of active ingredient in a given volume or weight of formulation.

Contaminate: To make impure or to pollute.

Corrosion: The process of wearing away by chemical means.

Crucifers: Plants belonging to the mustard family, such as mustard, cabbage, turnip, and radish.

Cucurbits: Plants belonging to the gourd family, such as pumpkin, cucumber, and squash.

Deciduous Plants: Perennial plants that lose their leaves during the winter.

Deflocculating Agent: A material added to a suspension to prevent settling.

Degradation: The process by which a chemical is reduced to a less complex form.

Dermal: Of the skin; through or by the skin.

Dermal Toxicity: Ability of a chemical to cause injury when absorbed through the skin.

Diluent: Any liquid or solid material used to dilute or carry an active ingredient.

Dilute: To make thinner by adding water, another liquid, or a solid.

Dispersing Agent: A material that reduces the attraction between particles.

Dormant: State in which growth of seeds or other plant organs stops temporarily.

Dose, Dosage: Quantity of a pesticide applied.

Emulsifier: A chemical which aids in suspending one liquid in another.

Emulsion: A mixture in which one liquid is suspended as tiny drops in another liquid, such as oil in water.

Fungistat: A chemical that keeps fungi from growing.

GPA: Gallons per acre.

GPM: Gallons per minute.

Growth Stages of Cereal Crops: (1) Tillering—when additional shoots are developing from the flower buds. (2) Jointing—when stem internodes begin elongating rapidly. (3) Booting—when upper leaf sheath swells due to the growth of developing spike or panicle. (4) Heading—when seed head is emerging from the upper leaf sheath.

Hard (water): Water containing soluble salts of calcium and magnesium and sometimes iron.

Herbaceous Plant: A plant that does not develop woody tissue.

Host: The living plant or animal a pest depends on for survival.

Hydrogen-Ion Concentration: A measure of acidity or alkalinity, expressed in terms of the pH of the solution. For example, a pH of 7 is neutral, from 1 to 7 is acid, and from 7 to 14 is alkaline.

Immune: Not susceptible to a disease or poison.

Impermeable: Cannot be penetrated. Semipermeable means that some substances can pass through and others cannot.

Lactation: The production of milk by an animal, or the period during which an animal is producing milk.

Larva: The early form of an insect from the time that it leaves the egg until it becomes a pupa.

LC50: The concentration of an active ingredient in air which is expected to cause death in 50 percent of the test animals so treated. A means of expressing the toxicity of a compound present in air as dust, mist, gas, or vapor. It is generally expressed as micrograms per liter as a dust or mist but in the case of a gas or vapor as parts per million (ppm).

LD50: The dose of an active ingredient taken by mouth or absorbed by the skin which is expected to cause death in 50 percent of the test animals so treated. If a chemical has an LD50 of 10 milligrams per kilogram (mg/kg) it is more toxic than one having an LD50 of 100 mg/kg.

Leaching: Movement of a substance downward or out of the soil as the result of water movement.

Mammals: Warm-blooded animals that nourish their young with milk. Their skin is more or less covered with hair.

Metamorphosis: A change in shape, form, and size in insects.

Miscible Liquids: Two or more liquids that can be mixed and will remain mixed under normal conditions.

MPH: Miles per hour.

Mutagenic: Can produce genetic change.

Necrosis: Localized death of living tissue such as the death of a certain area of a leaf.

Necrotic: Showing varying degrees of dead areas or spots.

Nitrophenols: Synthetic organic pesticides containing carbon, hydrogen, nitrogen, and oxygen.

Noxious Weed: A plant defined as being especially undesirable or troublesome.

Nymph: The stage of development in certain insects after hatching. They look like the adult but lack fully developed wings.

Oral: Of the mouth; through or by the mouth.

Oral Toxicity: Ability of a pesticide to cause injury when taken by mouth.

Organic Compounds: Chemicals that contain carbon.

Organochlorine: Same as chlorinated hydrocarbon.

Organophosphate: A synthetic organic pesticide containing carbon, hydrogen, and phosphorus; parathion and malathion are two examples.

Ovicide: A chemical that destroys eggs.

Parasite: A plant or animal that lives on or in another plant or animal from which it gets food.

Pathogen: Any disease-producing organism.

Penetration: The act of entering or ability to enter.

Pest: Living things that compete with man for food and fiber, or attack man directly.

Phytotoxic: Harmful to plants.

Pollutant: An agent or chemical that makes something impure or dirty.

PPB: Parts per billion. A way to express the concentration of chemicals in foods, plants, and animals. One part per billion equals 1 pound in 500,000 tons.

PPM: Parts per million. A way to express the concentration of chemicals in foods, plants, and animals. One part per million equals 1 pound in 500 tons.

Predator: An animal that destroys or eats other animals.

Propellant: Liquid in self-pressurized pesticide products that forces the active ingredient from the container.

PSI: Pounds per square inch.

Pubescent: Having hairy leaves or stems.

Pupa: The stage between the larva and adult in the development of some insects.

Respiratory Tract: Having to do with or used for breathing; the lungs and other parts of the breathing system.

Rhizome: A rootlike underground stem.

RPM: Revolutions per minute.

Safener: A chemical added to a pesticide to keep it from injuring plants.

Seed Protectant: A chemical applied to seed before planting to protect seeds and new seedlings from disease and insects.

Soil Sterilant: A chemical that prevents the growth of all plants and animals in the soil. Soil sterilization may be temporary or permanent, depending on the chemical.

Soluble: Will dissolve in a liquid.

Solution: Mixture of one or more substances in another in which all ingredients are completely dissolved.

Solvent: A liquid which will dissolve a substance to form a solution.

Spreader: A chemical which increases the area that a given volume of liquid will cover on a solid or on another liquid.

Sticker: A material added to a pesticide to increase its adherence.

Stolon: An above-ground stem that produces roots.

Surfactant: A chemical which increases the emulsifying, dispersing, spreading, and wetting properties of a pesticide product.

Susceptible: Capable of being diseased or poisoned; not immune.

Susceptible Species: A plant or animal that is poisoned by moderate amounts of a pesticide.

Suspension: Finely divided solid particles mixed in a liquid.

Synergism: The joint action of two or more pesticides that is greater than the sum of their activity when used alone.

Target Pest: The pest at which a particular pesticide or other control method is directed.

Tolerance: (1) The ability of a living thing to withstand adverse conditions, such as pest attacks, weather extremes, or pesticides. (2) The amount of pesticide that may safely remain in or on raw farm products at time of sale.

Toxicant: A poisonous chemical.

Trade Name: Same as brand name.

Vapor Pressure: The property which causes a chemical to evaporate. The lower the vapor pressure, the more easily it will evaporate.

Vector: A carrier, such as an insect, that transmits a pathogen.

Viscosity: A property of liquids that determines whether they flow readily. Viscosity usually increases when temperature decreases.

Volatile: Evaporates at ordinary temperatures when exposed to air.

Wetting Agent: A chemical which causes a liquid to contact surfaces more thoroughly.

☆U.S. GOVERNMENT PRINTING OFFICE: 1976 O-634-736

Weights and Measures

Weights
16 ounces = 1 pound
1 gallon water = 8.34 pounds

Liquid Measure
1 fluid ounce = 2 tablespoons
16 fluid ounces = 1 pint
2 pints = 1 quart
8 pints = 4 quarts = 1 gallon

Length
3 feet = 1 yard
16 ½ feet = 1 rod
5,280 feet = 320 rods = 1 mile

Area
9 square feet = 1 square yard
43,560 square feet = 160 square rods = 1 acre

Speed
1.466 feet per second = 88 feet per minute = 1 mph

Volume
27 cubic feet = 1 cubic yard

STUDY QUESTIONS
for
PRIVATE PESTICIDE APPLICATOR CANDIDATES

The purposes of pesticide applicator certification are to:

1. Prevent human poisoning from pesticide misuse;

2. Continue to increase maximum quality crop yields through pest management practices;

3. Prevent pesticide damage and occurrence of illegal pesticide residues on crops;

4. Protect the wildlife and the environment.

Certification of the pesticide applicator is earned by satisfactorily completing a written examination. Afterward he may purchase and apply federal and state restricted-use pesticides. The certification status assures that the applicator understands how to select and apply pesticides properly.

The private pesticide applicator examination involves the understanding of the state and federal laws, identifying and evaluating the importance of pest problems, selecting the necessary pesticide, and the ability to apply the pesticide properly without adversely affecting the environment.

Answers to most of these study questions can be found in the USDA-EPA "Apply Pesticides Correctly, a Guide for Private Applicators" (Core Manual), the Washington State Department of Agriculture (WSDA) Pest Control Handbook, and in Washington State University bulletins and circulars. With this general information plus the applicator's ability and practical experience, he should be prepared to satisfactorily complete the WSDA certifying examination. Attending a Cooperative Extension Service pesticide training meeting in your area before taking the examination will also be helpful.

LAWS AFFECTING PRIVATE APPLICATORS

Federal Insecticide, Fungicide and Rodenticide Act of 1947, known as FIFRA, was amended by Congress as Federal Environmental Pesticide Control Act as of October 21, 1972. Referred to as FEPCA and is enforced by Environmental Protection Agency.

1. Regulates the investigation, manufacture, registration, labeling, storage, transportation, sale, application, container and disposal of all pesticides.

2. Requires an approved State Plan. Washington's State Plan was accepted by EPA in January, 1976.

3. State Legislature has approved Washington State Department of Agriculture (WSDA) Pesticide and Control Acts with enabling legislation. The two Acts are quite similar to FEPCA. EPA has granted enforcement authority to WSDA.

4. Congress has extended FEPCA enforcement date to 10/21/77.

   (a) Requires all pesticides to be categorized as general-or restricted-use. This is based on hazard to man, animal, crop and environment.

   (b) Requires all applicators who purchase and apply restricted-use pesticides to be certified (by WSDA).

5. Grants state authority to provide special provisions for emergencies. These may change at any time.

   (a) Private applicator to use one restricted-use pesticide once.

   (b) Private applicator to apply restricted-use pesticide throughout the season, as needed.

   (c) Private applicator to apply restricted-use pesticide for one or more years.

   (d) All applications must be consistent with label directions.

6. Civil and criminal penalties are based on degree of violation and preapplication knowledge of misuse.

6. (a) Federal penalties are a fine and imprisonment or both.

   (b) State penalties are generally misdemeanors and vary from a written warning to a fine and/or a loss of license.

7. Be able to recognize pests (insect, weed, disease, rodent and bird) and evaluate potential damage.

8. Understand pesticide label directions.

9. Prepare and apply sprays properly.

10. Contact county agents, consultants and WSDA for assistance.

LAWS

1. Name the federal and the state agency responsible for enforcing pesticide laws.

2. Who determines the pesticide restricted-use status on the federal level? On the state level?

3. Which pesticides do not require state registrations?

4. What state agency issues pesticide-use permits?

5. When must a pesticide be registered in Washington?

6. What groups of people consult with the Director of Agriculture on pesticide matters? Who do these people represent?

7. In Washington an unlawful pesticide act is classed as ____________________________.

8. What is the difference between a civil and a criminal violation? What may be the penalty for a civil violation? A criminal violation?

9. Is it legal or illegal to use a pesticide on a crop not listed or to control a pest not listed on the pesticide container label?

10. How often must a private pesticide applicator's license be renewed?

THE PESTICIDE LABEL

A very expensive and all-inclusive document. Always read the label before purchasing a pesticide!

After 10/21/77, restricted-use pesticide labels will list:

1. Brand or trade name
2. Kind of pesticide - insecticide, avicide, etc. - and kind of formulation
3. Percent of each active ingredient, along with common name and chemical name
4. Percent of inert ingredients
5. Restricted-use pesticide
    (a) Danger, skull and crossbones sign, and "Poison" in red
    (b) Keep out of Reach of Children
    (c) Statement of practical treatment
        - if swallowed
        - if inhaled
        - if on skin
        - if in eyes
6. Manufacturer's name and address
7. EPA's registration number
8. Establishment registration number
9. Net contents
10. Precautionary statements: hazards to humans, animals, environmental hazards, hazards to pollinators
11. Physical or chemical hazards
12. Directions for use: air or ground application
    (a) Crops, pests, dosages, timing
    (b) Reentry statement
    (c) Days to slaughter

13. Category of applicator

14. Storage and disposal

15. Warranty statement

16. Flammability

17. Signal words

    (a) Highly toxic, Class I, Danger - Poison, LD_{50} up to 50

    (b) Moderately toxic, Class II, Warning, LD_{50} of 50 to 500

    (c) Slightly toxic, Class III, Caution, LD_{50} of 500 to 5,000

    (d) Relatively non-toxic, Class IV, LD_{50} over 5,000

THE LABEL

1. Distinguish between EPA registration number and Establishment registration number.
2. What portion of the pesticide label will the doctor need when you are reporting a pesticide accident to him?
3. How often are labels reregistered with EPA? With WSDA?
4. Is it legal to apply a pesticide from an airplane when there are directions for ground application on the container label?
5. What does the word "WARNING" mean on the label? What is the toxicity class? What is the LD_{50} range? What does LC_{50} mean?
6. Pesticides which are highly toxic to man have what precaution information on the label?
7. Where are the trade or brand name, common name and chemical name found on the container label?
8. Are antidotes listed on Class I container labels? Of what value are they?
9. Why should the applicator always follow the dosage rate information?
10. Is the flammability rating of the pesticide listed on the label? Under what situations would this information be valuable?
11. What is the purpose of the reentry statement?
12. Why are days to slaughter and days to harvest important to the applicator?
13. Name the four different times you should read the label and give the reasons why for each.
14. What directions for use can you find on the label?

PESTICIDE FORMULATIONS

1. Define: phytotoxicity, dust (D), granular (G), flowable powder (F), soluble powder (SP), emulsifiable concentrate (EC), baits (B), slurry, suspension, solution, solvent and detergent.
2. Name examples for each class of formulation in Question 1.
3. Why is it necessary to formulate pesticides?
4. Will a surfactant be needed when treating plants with hairy leaves? With a waxy leaf surface? Why?
5. What are your best sources of information when preparing tank mixes?
6. What are buffers? Under what circumstances are they used?
7. Why should D treatments be avoided?
8. Why are EC treatments sometimes damaging to plants, while wettable powder (WP) treatments are not?
9. How many pounds of AI pesticide are in a pound of 50% WP formulation?
10. How many pounds of AI pesticide are in a quart of 2 EC formulation?
11. Which pesticide formulation is generally most readily absorbed through the skin?
12. Distinguish between EC and miscible pesticide formulations.

PESTICIDE CHEMISTRY

1. Define: pesticide, fungicide, avicide, ppm, ppb, chemistry, persistent chemical, trade name, common name, chemical name and specific.

2. Why are most pesticides considered to be non-specific in their action?

3. Name three major classes of pesticides.

4. How do most insecticides kill insects? Other animals? Why are plants not killed this way?

5. Name the major chemicals that chlorinated hydrocarbons are composed of; that carbamates are composed of; that organophosphate pesticides are composed of.

6. How to triazene, phenoxy and carbamate herbicides kill plants?

ENTOMOLOGY

1. How many body regions do all insects have? How many do all spiders have?

2. How many pairs of legs and wings do all insects have? How many do all spiders have?

3. You have found a fly maggot. What are the other growth stages of all flies? What is this kind of metamorphosis (growth) called? How did you know it was a fly maggot? Name five pest insects and five beneficial insects that grow this way.

4. You have found a variegated cutworm larva. What kind of mouthparts does it have? What kind of mouthparts does the adult cutworm moth or miller have? Name three other pests that have these kinds of mouthparts.

5. You have found an adult apple leafhopper. What are the other growth stages of all leafhoppers? What is this kind of metamorphosis called? Name three pest insects and five beneficial insects that grow this way.

6. You have found a wireworm larva. What kind of mouthparts does it have? What kind of mouthparts does the adult wireworm or click beetle have? How do you distinguish the wireworm larva from the cutworm larva?

7. Your apple tree (rose or wheat plant) is infested with aphids. What kind of mouthparts do they have? Name two ways aphids damage plants. What other pest insects have this kind of mouthparts?

8. Based on the mouthparts, feeding habits, flight activities and your knowledge, what kind of an insecticide (contact, systemic, stomach poison) would you use to control infestations of apple leafhopper, codling moth, apple aphid, flower thrips, army cutworm, Great Basin wireworm, ten-lined June beetle, alfalfa weevil, corn earworm, sugar beet root maggot, alfalfa looper, green peach aphid, Colorado potato beetle, grasshoppers and pea leaf weevil?

9. Spider mites have what kind of mouthparts?

10. What characteristics determine whether an insect is a pest or is beneficial?

11. Define natural, biological and cultural control.

12. Compare pest management with integrated pest control.

13. What economic factors limit biological pest control?

14. What limits predators from satisfactorily controlling pest insect populations over large cropping areas?

15. Define botanical pesticide, host insect, parasite, vector, pupa, nymph, ovicide, target pest and pest.

PLANT DISEASES

1. Define plant disease. Name the two types of plant diseases.

2. How does a diseased plant differ from a healthy plant?

3. What three conditions are needed before a parasitic disease can successfully attack healthy plants?

4. What conditions are needed for a non-parasitic disease to injure a healthy plant?

5. Define saprophytic, photosynthesis, epidermis, pathogen, zoospores, susceptibility, canker, chlorosis, necrosis, wilt, causal agent, cyst, climatic factors, bacteria, virus, fungus, compatible, infection, infestation, adsorption and absorption.

6. Name three different classes of parasitic diseases.

7. Name three non-parasitic plant diseases. What are the plant symptoms of each?

8. How does a contact fungicide protect a plant? To be effective, when should it be applied?

9. How does a systemic fungicide protect a plant? To be effective, when should it be applied? Name one.

10. Is plant breeding a good or poor method of plant disease control? Why?

11. What are the disadvantages of plant breeding as a method of plant disease control?

WEED CONTROL

1. Define contact herbicide, hormone, systemic herbicide, soil sterilant, preplant herbicide, preemergent herbicide, post-emergent herbicide, deciduous plants, desiccant, defoliant, high volatile ester, amine, rhizomes, xylem and tuber.

2. Name and example of each herbicide (trade or common name) listed in Question 1.

3. Define annual broadleaf plant, annual grass, biennial, perennial and monoecious plants. Name two examples of each.

4. What are surfactants and wetting agents? When should they be added to a herbicide spray solution?

5. Explain cultural weed control.

6. How does a sandy, a loam, a muck soil influence the kind of herbicide, dosage and timing of herbicide treatments?

7. How does the growth of a pigweed differ from that of a bindweed plant? In what stage of development is each most satisfactorily controlled and with what herbicide?

8. How does the growth of crabgrass differ from that of quackgrass? What herbicide would you select to control these grasses? When would the treatments be applied? Why at this time of year?

9. Under what conditions would an insoluble herbicide be preferred over a soluble herbicide? Why?

10. Why should post-emergence herbicides be selective?

11. Why is the possibility of soil leaching an important consideration when selecting a herbicide?

12. Name two persistent phenoxy herbicides. What makes them persistent?

13. Name the different ways herbicides kill plants.

APPLICATION EQUIPMENT

1. What is the purpose of pesticide application equipment sprayers?

2. Name three basic types of ground sprayers.

3. Name the parts of a typical sprayer nozzle. What is the purpose of each part? How often should sprayer nozzles be cleaned?

4. List the steps in nozzle-capacity-calibration.

5. List the procedural steps in sprayer (gallons per acre) calibration.

6. How often should the nozzles be checked for capacity output when flowable pesticides have been used? When EC pesticides have been used? When WP pesticides have been used?

7. What different kinds of materials are used in the manufacture of nozzle parts? Which wears the fastest? Which lasts the longest? Which kinds are the least subject to corrosion?

8. Why should the boom nozzle alignment be frequently checked?

9. What are the advantages/disadvantages in using a mixture of nozzles of different sizes and angles at the same time? Is it wise to mix nozzle brands?

10. How does the swirl plate affect the spray pattern?

11. How does the pump pressure affect the droplet size?

12. How does the boom height alter the spray pattern?

13. What is meant by double spray pattern? Under what conditions or situations is the double spray pattern preferred?

14. Define LV, ULV, and full coverage spraying. Under what situations are each used?

15. Why shouldn't water from an irrigation creek be used to fill sprayer tanks?

16. At what intervals should all pesticide sprayers be recalibrated? Why?

17. What steps are necessary to winterize pesticide sprayers?

18. What different materials are sprayer tanks made of? Name the advantages, the disadvantages of of each material.

19. When is mechanical agitation preferred?

20. What hose materials are preferred when using oil base sprays?

21. What effect does a small ID hose have on the effectiveness of the sprayer?

22. Why is the boom angle (horizontal) important?

23. What is the value of a quick cutoff valve?

24. What environmental factors increase the possibility for pesticide drift?

25. How are sprayers altered to reduce the drift hazard?

26. What time of day are spray treatments less likely to drift?

SAFE USE OF PESTICIDES

1. Define cholinesterase, antidote, symptoms, poison, toxic, hazardous, contaminated, acute, chronic, dermal, oral, inhalation and potentiation.

2. How do pesticides get into the body?

3. In what manner can you protect yourself from pesticides entering your body while you are handling pesticide containers, preparing and applying sprays?

4. The skull and crossbones and the words "Danger" and "Poison" in red is found on what class of pesticides?

5. Is this class of pesticide (Question 4) considered as a toxic, hazardous, a restricted-use or a non-restricted-use pesticide? What is this classification based on? What agency determines the classification?

6. Where on the restricted-use pesticide container label will the precautions and suggestions for protecting the applicator be found?

7. What class of pesticides has the signal word "Warning," the signal word "Caution" and the statement "Keep Out of Reach of Children" on the container label?

8. List the progressive signs and symptoms that generally accompany excessive exposure to a toxic pesticide.

9. What should you do when poisoning symptoms develop the day following exposure to a toxic pesticide? What one thing do you always do when you visit a doctor after exposure to a highly toxic pesticide?

10. How soon after contamination should pesticides be removed from your skin? From your clothes? List the steps in cleansing your body. Your clothes.

11. Name the different items of clothing, from head to foot, that must be worn when transporting, preparing and applying pesticides, washing spray machines and in cleaning up accidental highly toxic pesticide spills. How are Class I pesticides safely transported on the highway? By grower?

12. How are the hazards of handling empty highly toxic pesticide containers reduced? How and where should the empty highly toxic pesticide containers be stored? How should they be disposed of?

13. After handling, mixing, spraying a toxic pesticide, list the procedure used in washing each item of protective equipment? Where should your protective equipment be stored until it is needed?

14. Why are unlined boot and gloves preferred when handling toxic pesticides? How are leather shoes decontaminated after being saturated with an organophosphate?

15. For personal protection, are the trouser legs stuffed into the boots or left outside the boots when spraying "over head"? Are the sleeves inside or outside the gloves when spraying over head? What determines where the trouser legs and sleeves are in relation to the boots and gloves?

16. How often and when should respirator cartridges be replaced?

17. When is a self-contained breathing apparatus needed?

18. Where should pesticides be stored? What kind of flooring is preferred? Ventilation, heating, general temperature and door characteristics? What should the door label say? Where should the key to the door lock be kept?

19. Where should the pesticide storage be located in relation to food- and feed-stuff storage and in relation to animal and human living quarters?

20. Where are Washington's poison control centers located? What kinds of assistance can poison control centers provide?

21. What should you do before opening a pesticide container?

ANIMAL DAMAGE CONTROL

1. What is vertebrate pest control?
2. Name four methods of vertebrate pest control.
3. What factors are used to determine the need for vertebrate pest control?
4. Name the characteristics of the "ideal chemical" for wildlife or vertebrate pest control.
5. List the ways pocket gophers, moles, rats and mice cause damage.
6. How far do pocket gophers generally range? What is the usual depth range of their tunnels? How many gophers generally live in each tunnel system? What is the best pocket gopher control method?
7. How far do moles generally range? What is the usual depth of their tunnels? How many moles generally live in each tunnel system? What is the best method of mole control?
8. How do you distinguish pocket gopher mounds from mole mounds?
9. Why do mice survive better during winters that have a good snow cover?
10. How many litters do meadow mice have each year?
11. How much food does a meadow mouse consume each day?
12. Name three ways meadow mice can be controlled.
13. List the campaign control procedures necessary to organize a control of a rat, mouse, mole and pocket gopher infestation.
14. How are pets and children protected when poison baits are used to control vertebrate pests?
15. Where are bait stations placed for mouse control?
16. Where are rat traps placed for best results?
17. How are pesticides used in rat and mouse control?

BOOM-TYPE SPRAYER NOZZLE CAPACITY PROBLEMS

1. Collections from four nozzles are 7.6, 6.8, 8.4 and 6.9 ounces. Which nozzle disc(s) should be replaced to prevent a streaked spray pattern?
2. Collections from four nozzles are 17, 21, 24 and 23 cc (cubic centimeters). Which nozzle disc(s) should be replaced to prevent a streaked spray pattern?
3. Collections from three nozzles are 18, 23 and 24 cc (cubic centimeters). Which nozzle disc(s) should be replaced to prevent a streaked spray pattern?

DETERMINING RATE PER ACRE OF BOOM-TYPE SPRAYER

1. After spraying a swath 20 feet wide and 680 feet long, you find that it took 6.8 gallons to refill the sprayer tank. How many gallons per acre does the sprayer apply?
2. After spraying a swath 32 feet wide and 700 feet long, you find that it took 5.2 gallons to refill the sprayer. How many gallons per acre does the sprayer apply?

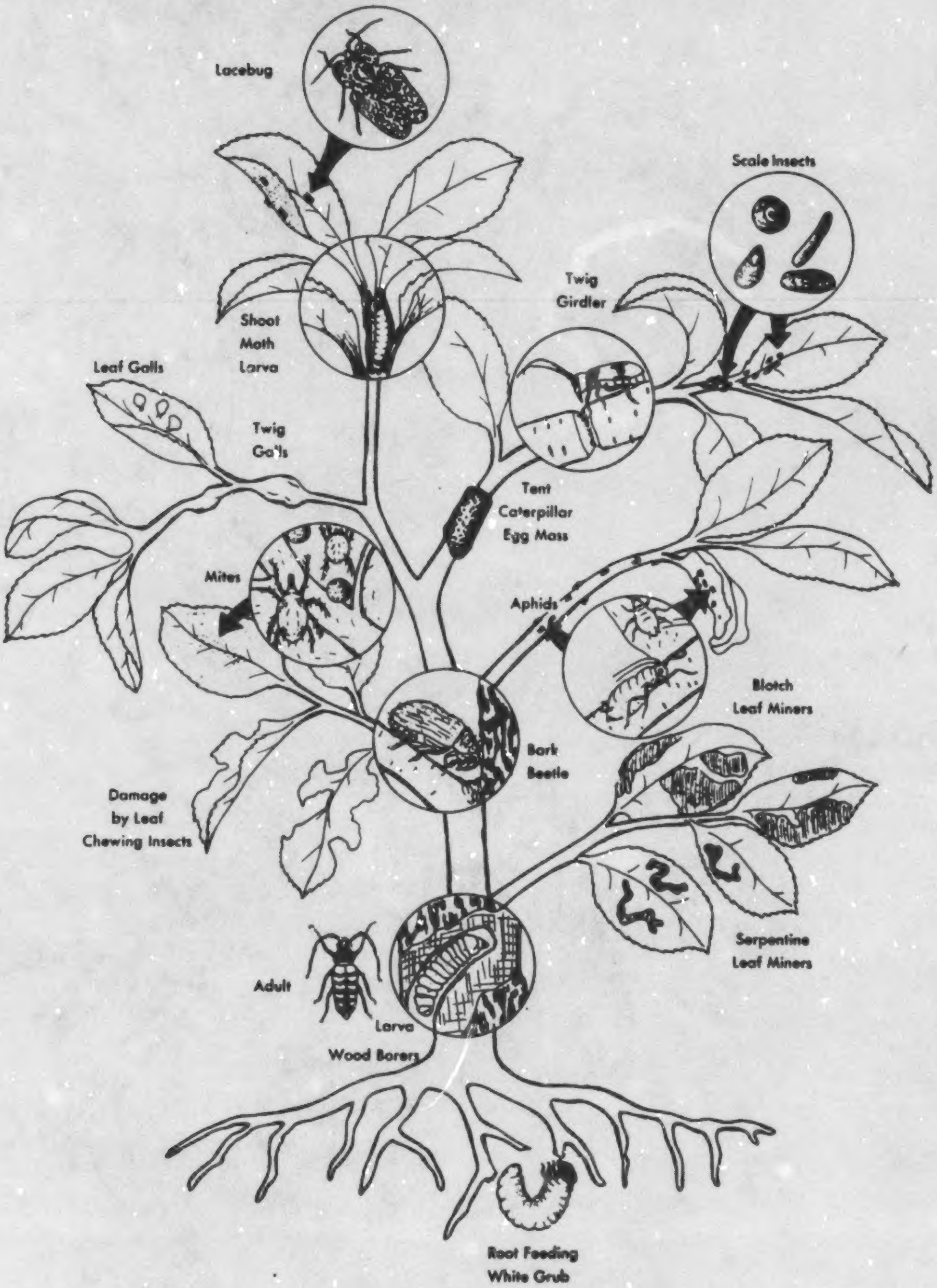
DETERMINING HOW MUCH PESTICIDE TO USE

SITUATION: You have a 5 pound EC. PROBLEM: How many acres will one gallon of 5 lb. EC treat at the rate of 1.25 lb. per acre? PROBLEM: How many gallons of 5 lb. EC are needed to treat an 80 acre field with 1.25 lb. AI per acre?

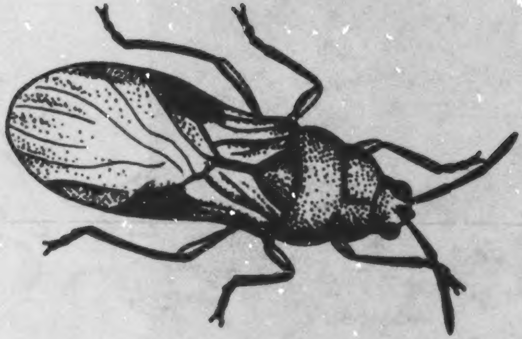
SITUATION: You have a 2 lb. EC. PROBLEM: How much is needed to apply one pound AI per acre: PROBLEM: How many gallons are needed to treat 84 acres with 1 lb. AI per acre: PROBLEM: How many gallons are needed to treat 160 acres with 1.5 lb. AI per acre?

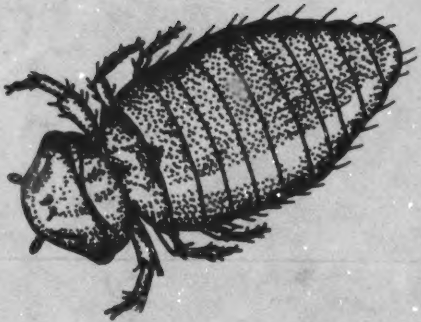
SITUATION: You have a supply of 80 SP. PROBLEM: How much is needed to apply 1.6 pounds active ingredient per acre? How much is needed to apply 2. lb. AI per acre? How much is needed to treat 85 acres with 1.6 lb. AI per acre?

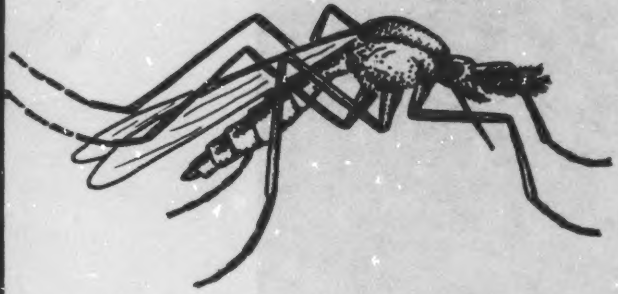
Insect Damage

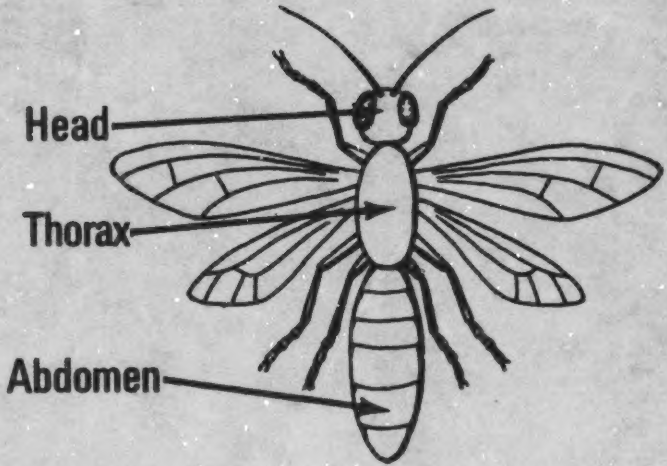

Lacebug
Scale Insects
Twig Girdler
Shoot Moth Larva
Leaf Galls
Twig Galls
Tent Caterpillar Egg Mass
Mites
Aphids
Blotch Leaf Miners
Bark Beetle
Damage by Leaf Chewing Insects
Serpentine Leaf Miners
Adult
Larva
Wood Borers
Root Feeding White Grub

Adult Insects

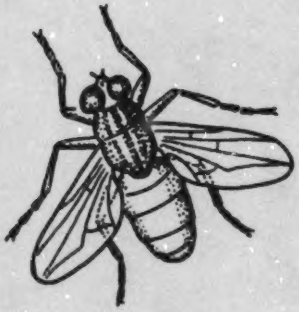




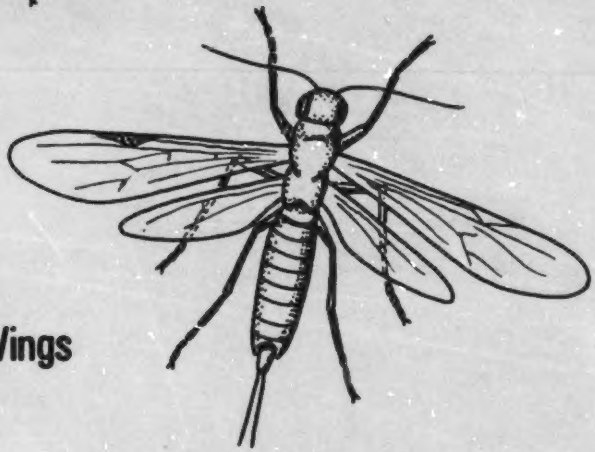



Head
Thorax
Abdomen

Wings and Mouthparts

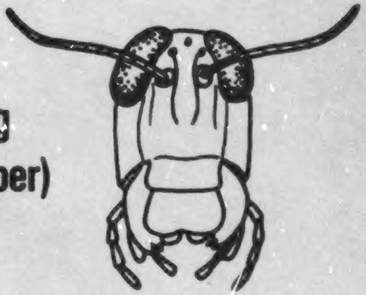


Two Wings

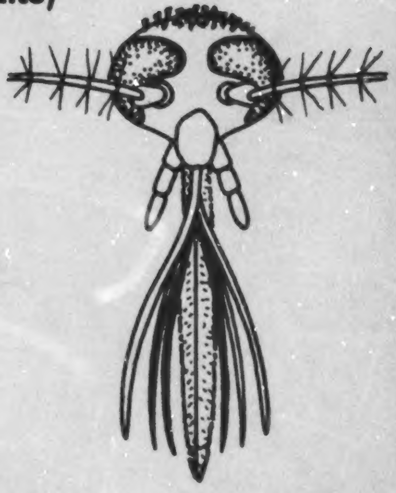


Four Wings

Wings



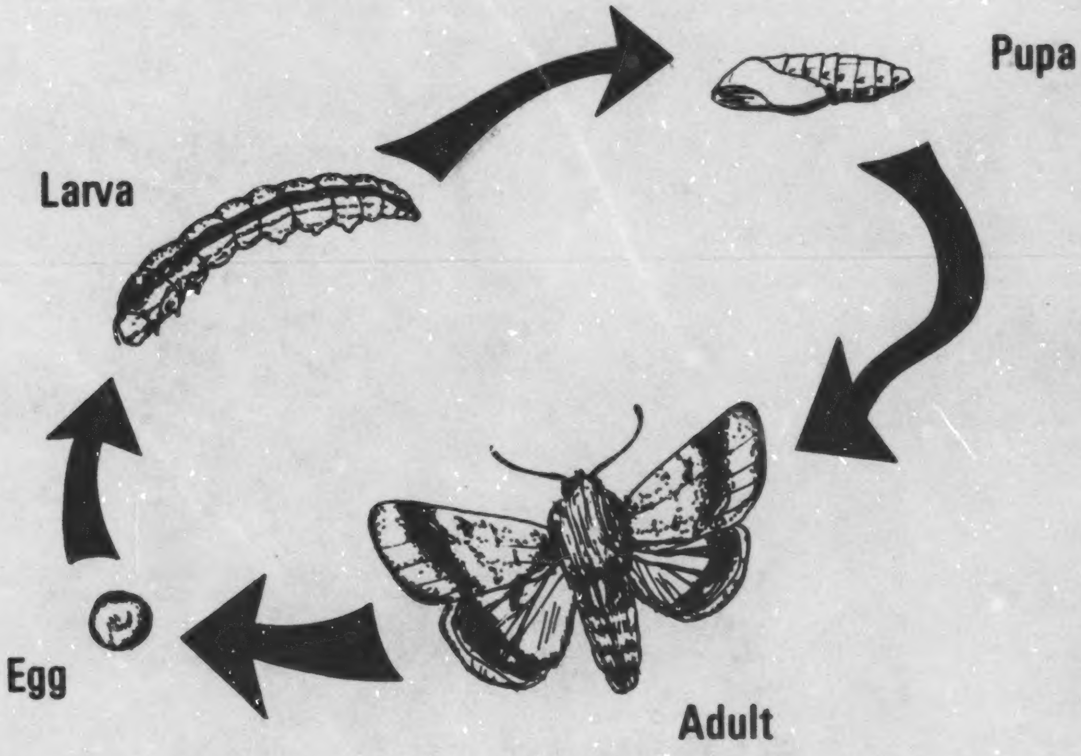
Chewing (Grasshopper)



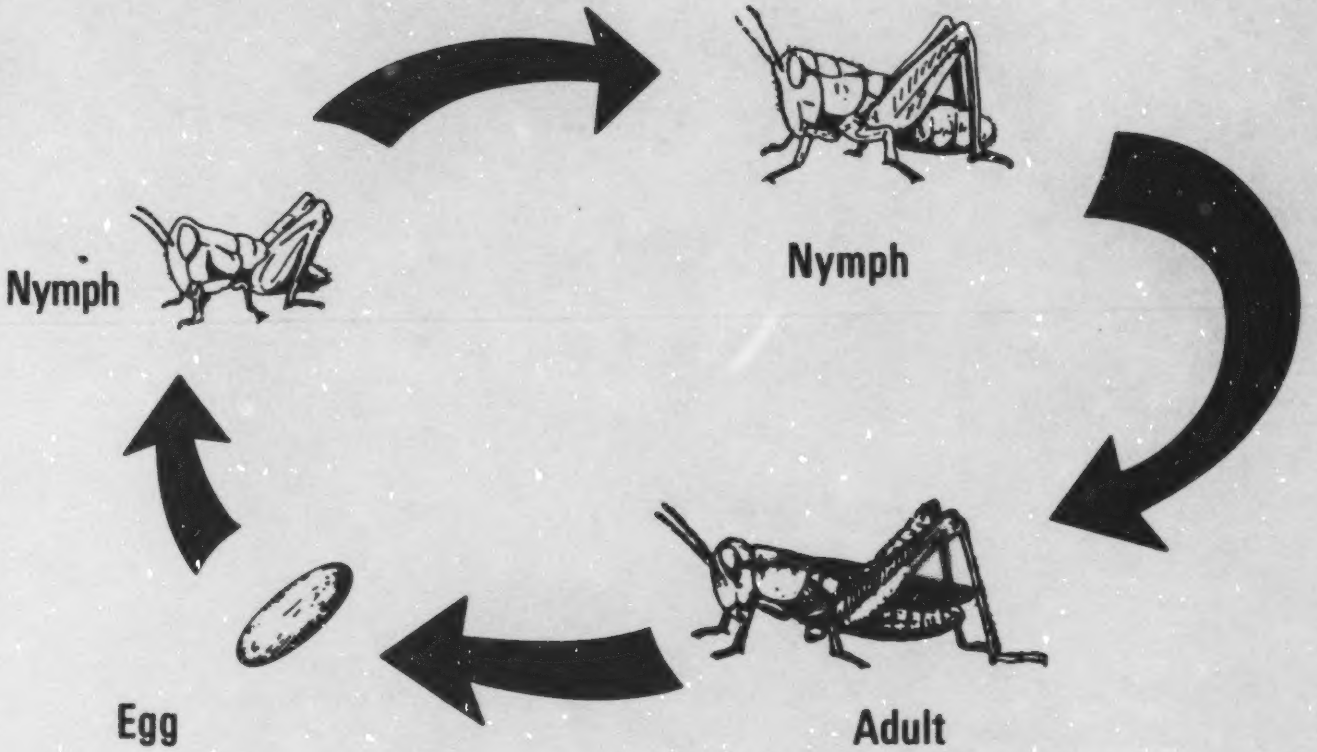
Sucking (Mosquito)

Mouthparts

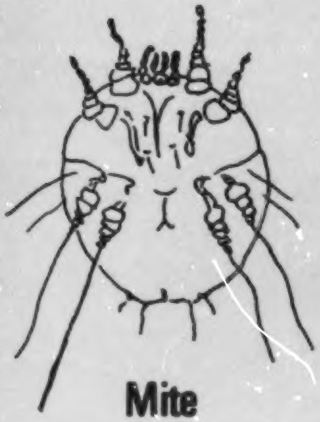
Four Stage Life Cycle


Pupa
Larva
Egg
Adult

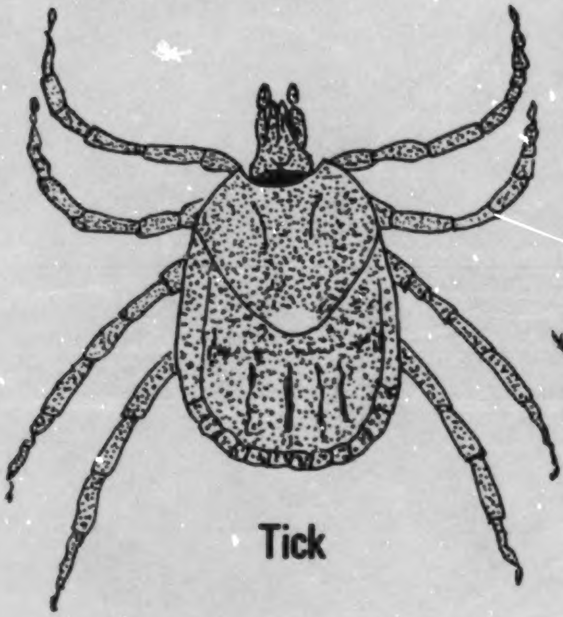
Three Stage Life Cycle


Nymph
Nymph
Adult
Egg

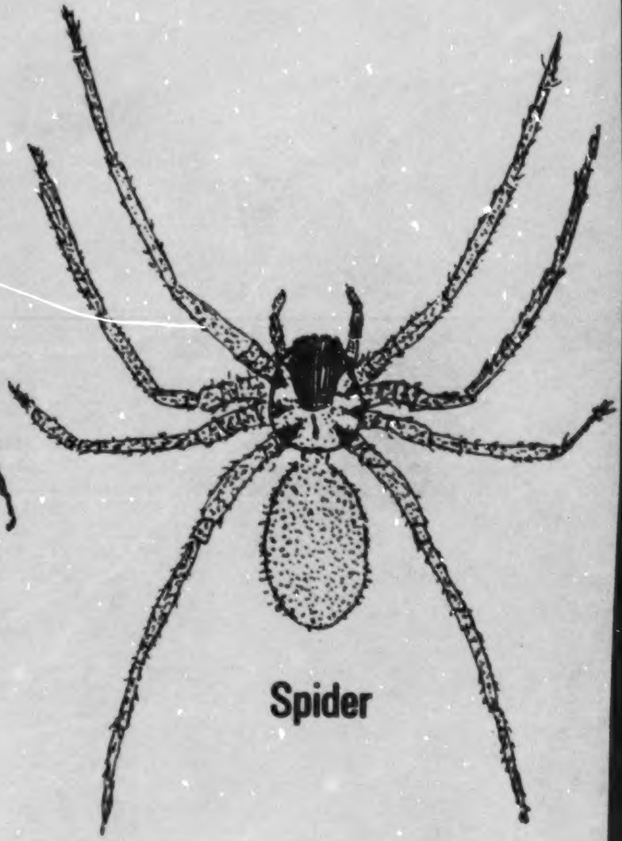
Mite, Tick, and Spider



Mite

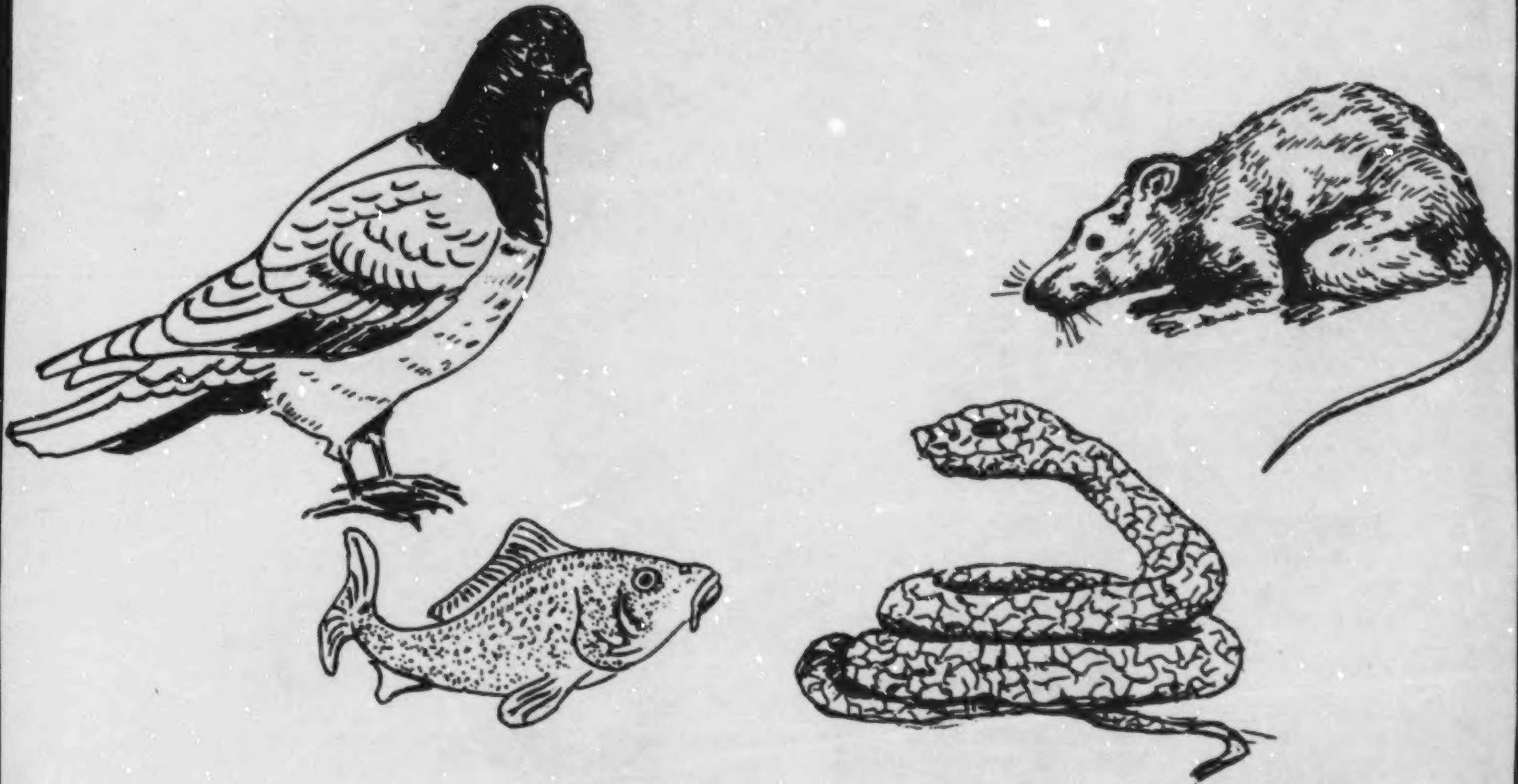


Tick

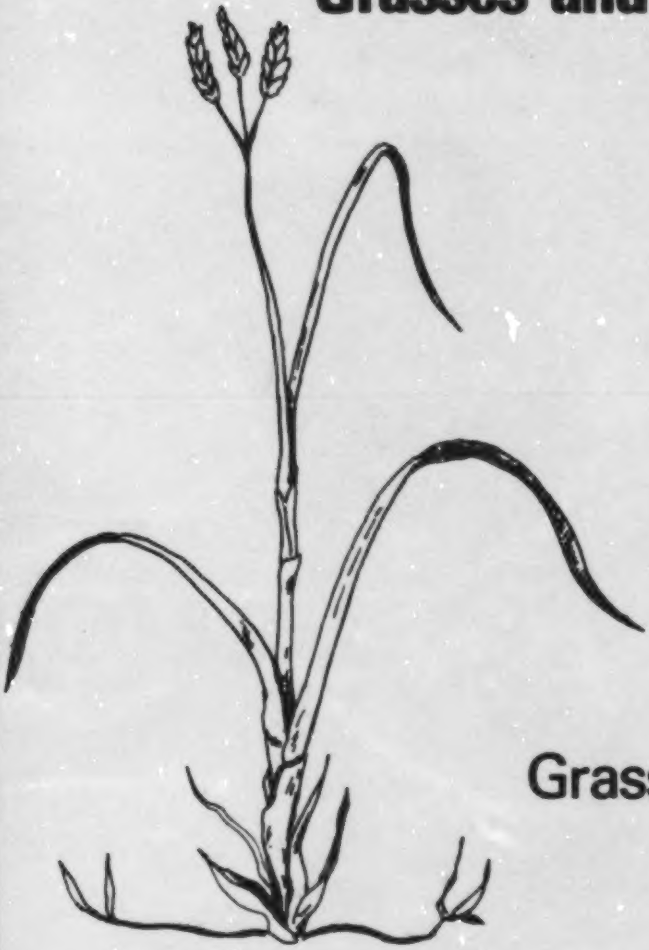


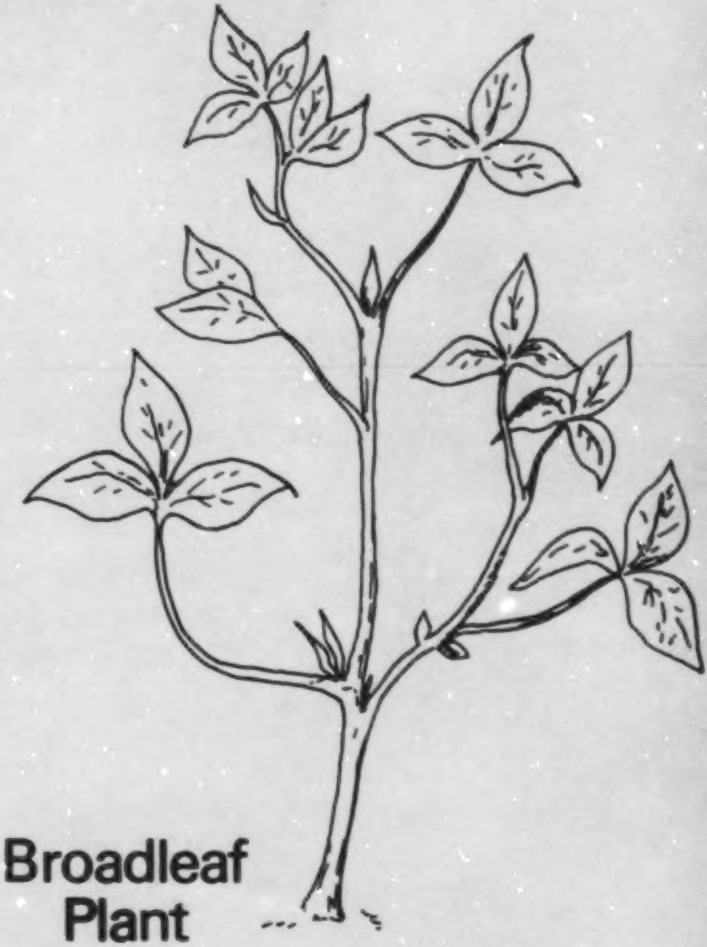
Spider

Vertebrate Pest Animals

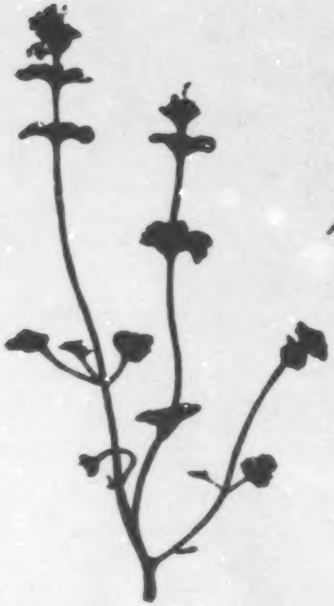


Grasses and Broadleaf Plants

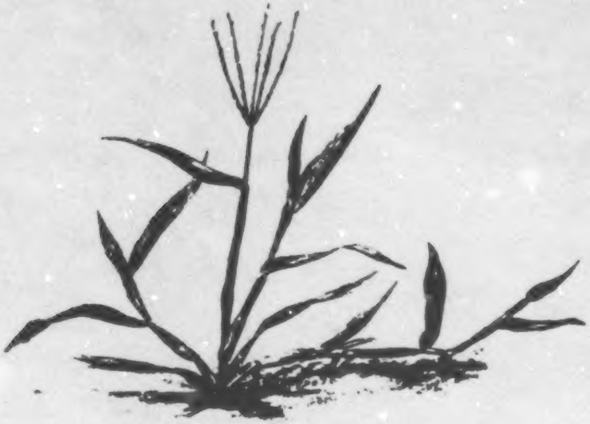



Broadleaf
Plant

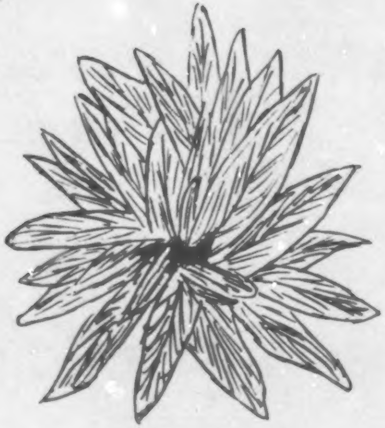
Annuals, Biennials, and Perennials



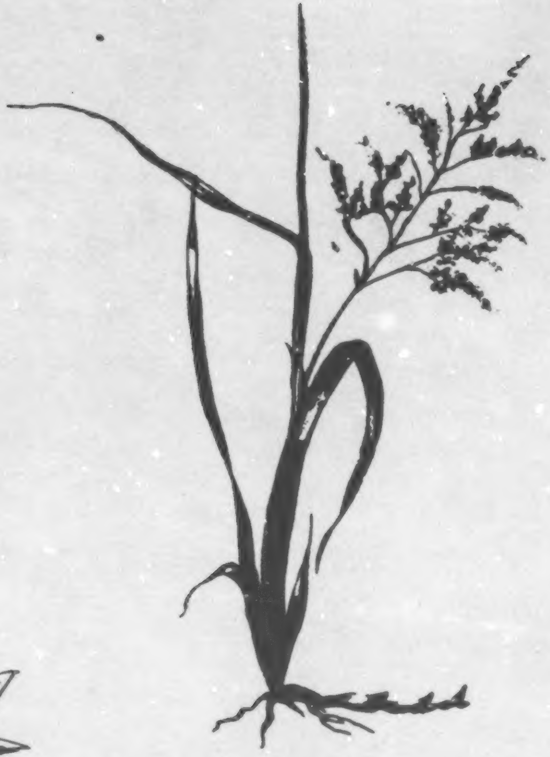
Winter Annual
(Henbit)



Summer Annual
(Crabgrass)



Biennial
(Mullein)

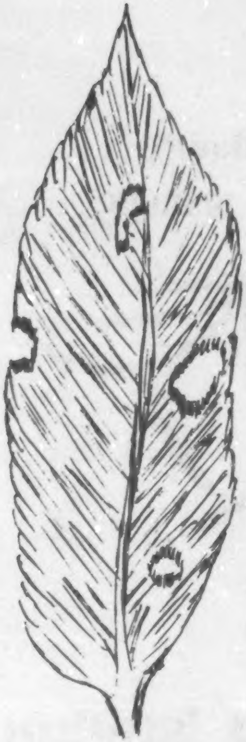


Perennial
(Johnson Grass)

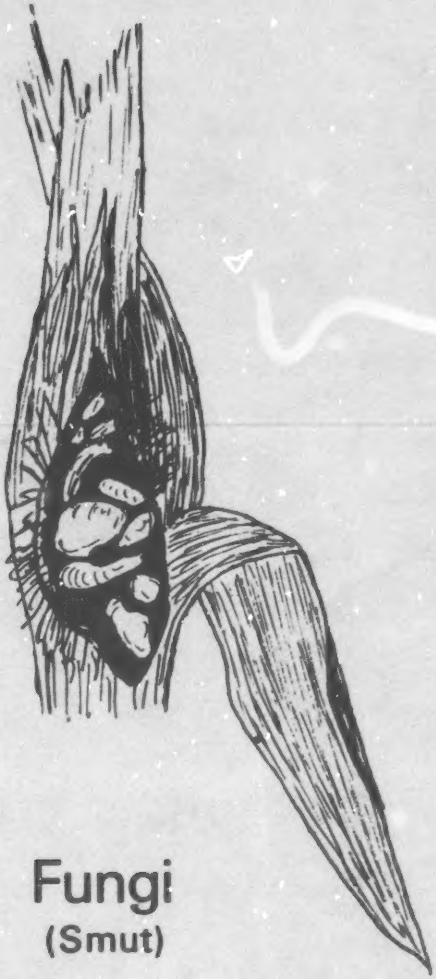
TM 9
Ag IV - XII - 57

Ag IV - XII - 58

Parasitic Causes



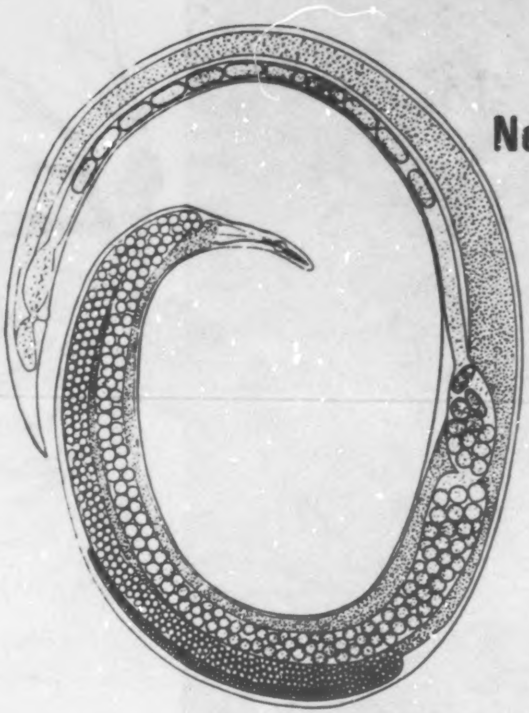
Bacteria
(Leaf Spot)



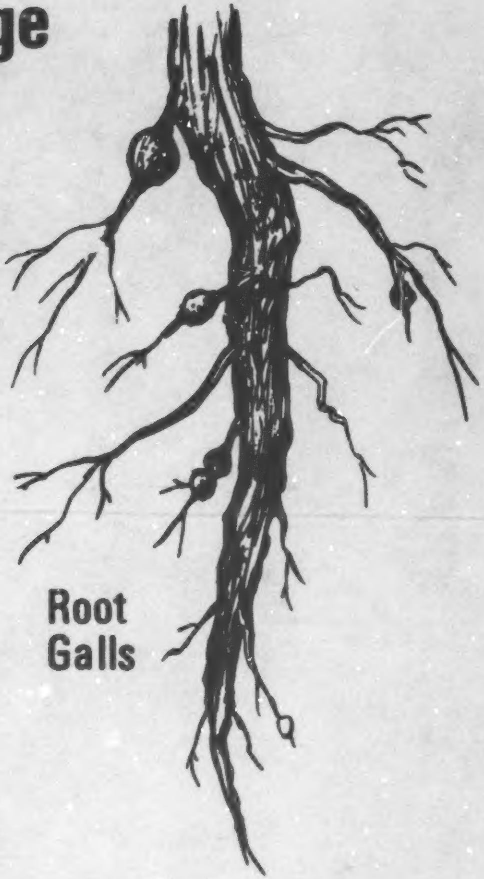
Fungi
(Smut)

TM 10

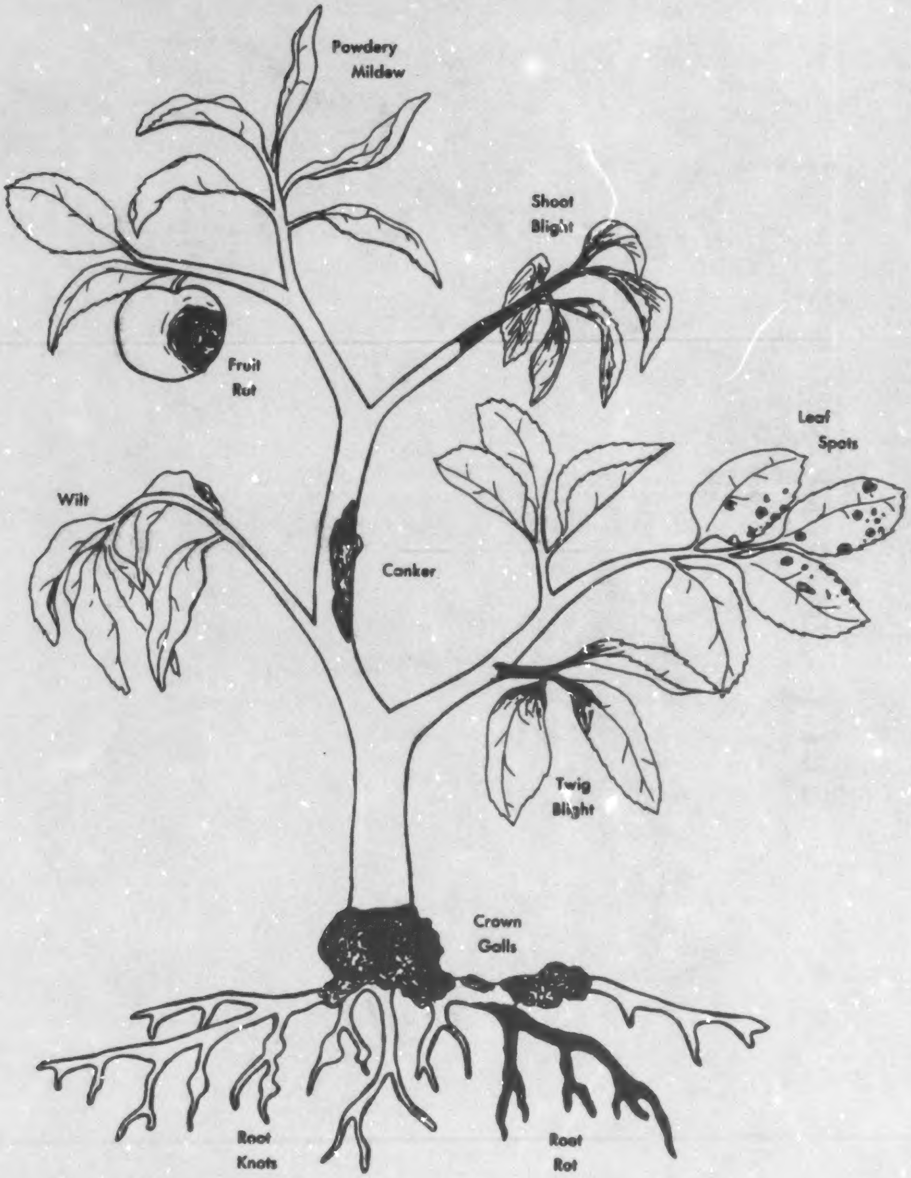
Nematode Damage



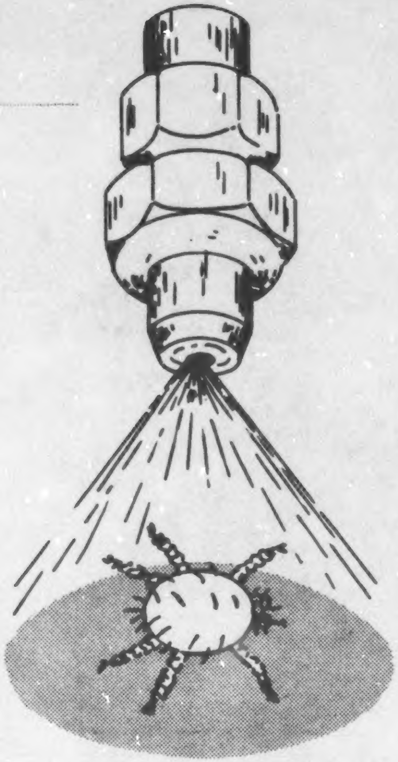
Actual Length Equals 1/50 to 1/25 Inch



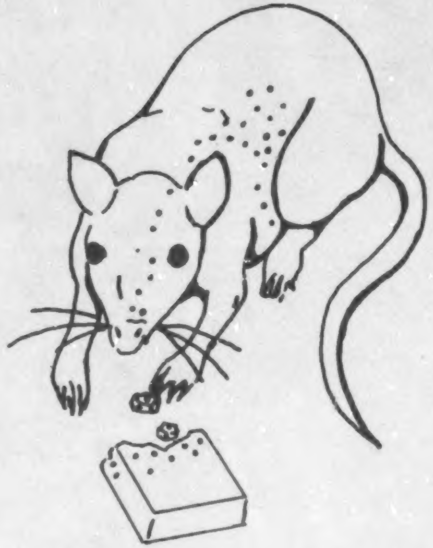
Symptoms of Diseases


Powdery
Mildew
Shoot
Blight
Fruit
Rot
Leaf
Spots
Wilt
Canker
Twig
Blight
Crown
Galls
Root
Knots
Root
Rot

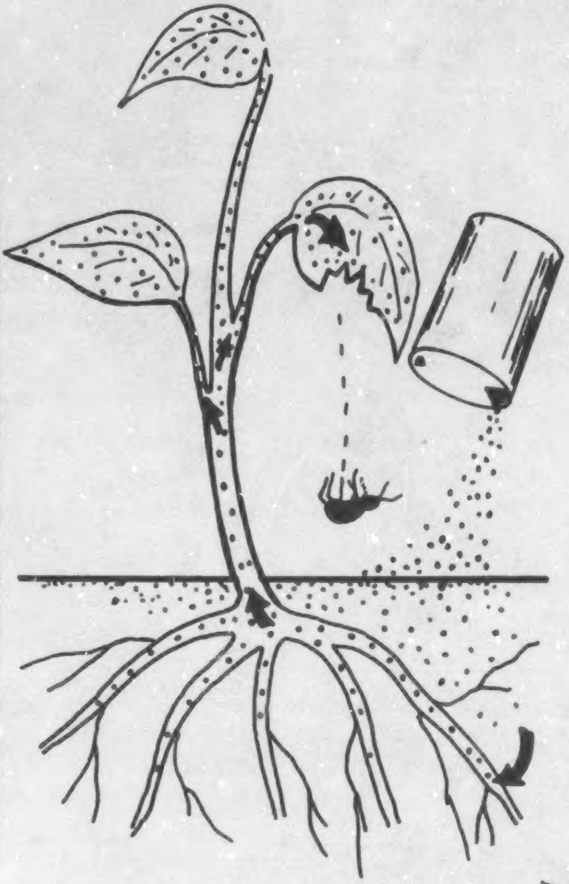
Ways Pesticides Attack Pests



Contact Poison

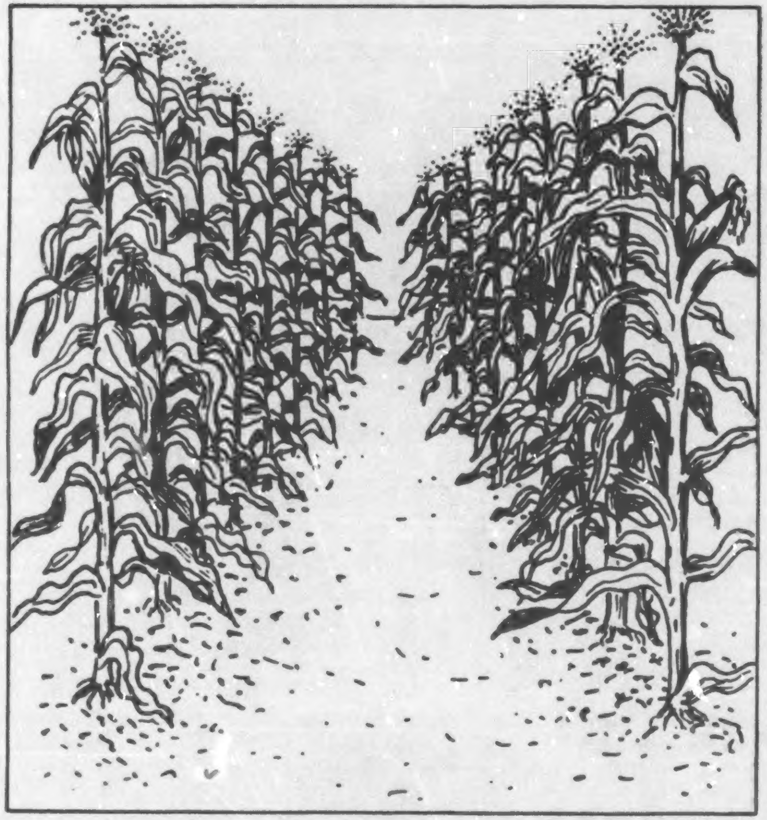


Stomach Poison

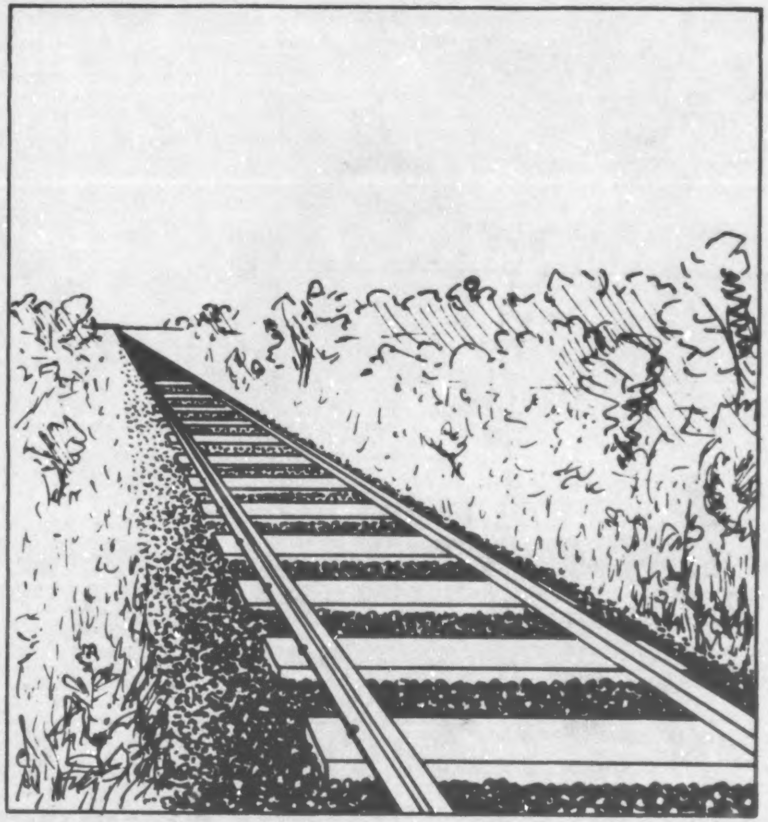


Systemic Poison

Selective vs Nonselective Herbicide

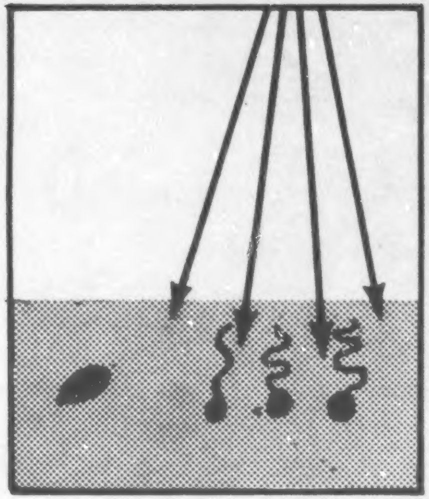


Selective

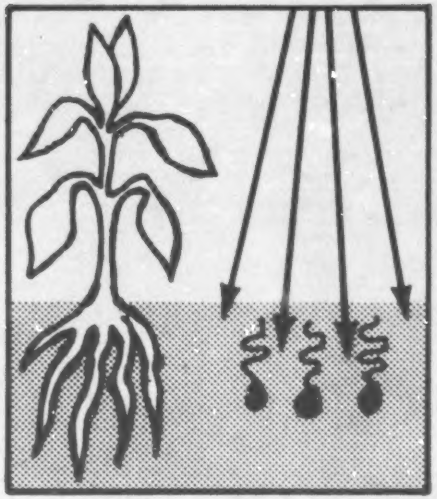


Nonselective

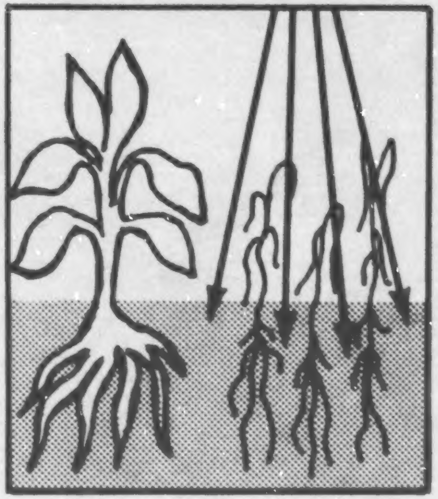
Preemergence and Postemergence



Preemergence to the
Crop and Weeds



Postemerged Crop
Preemerged Weeds

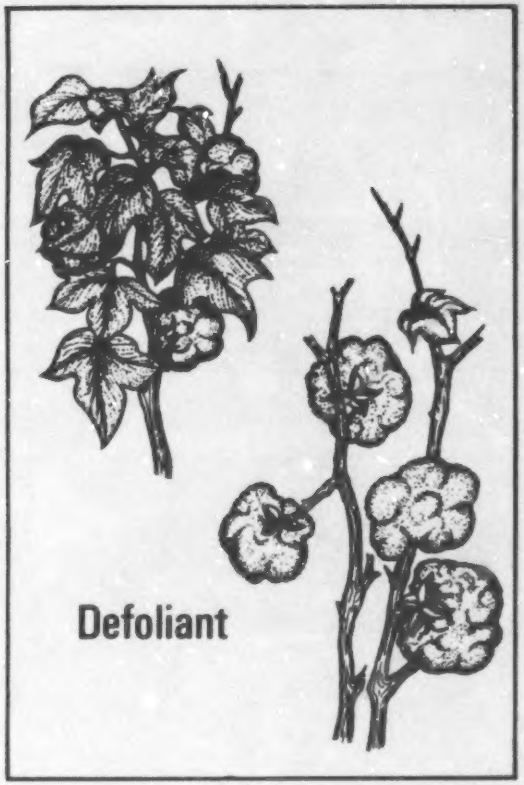


Postemergence to the
Crop and Weeds

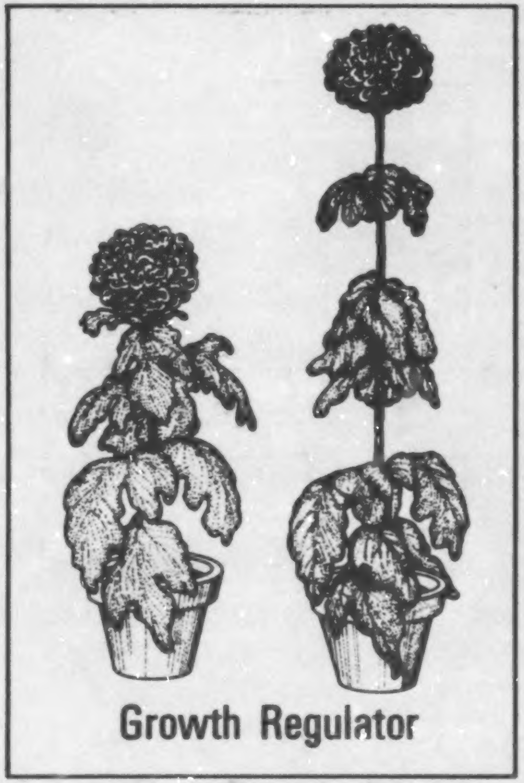
TM 3
Ag IV - XII - 63

Ag IV - XII - 64

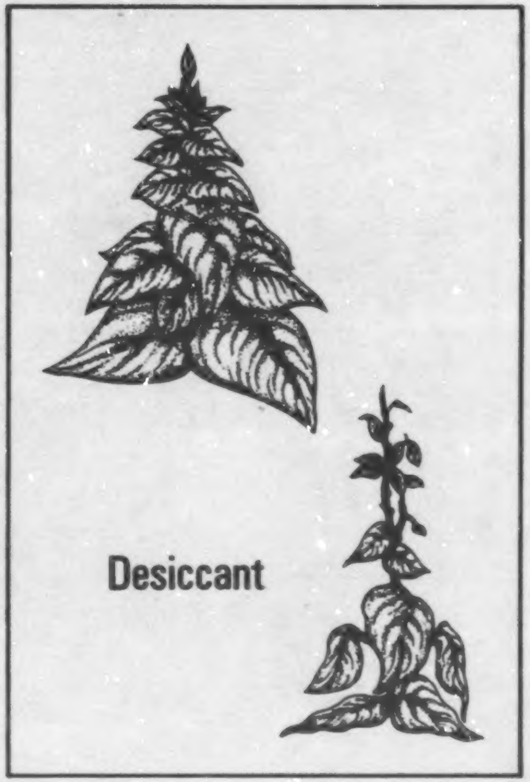
Chemicals Which Alter or Change Normal Plant Growth



Defoliant



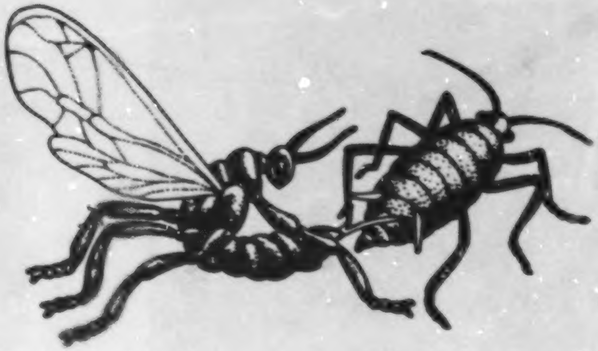
Growth Regulator



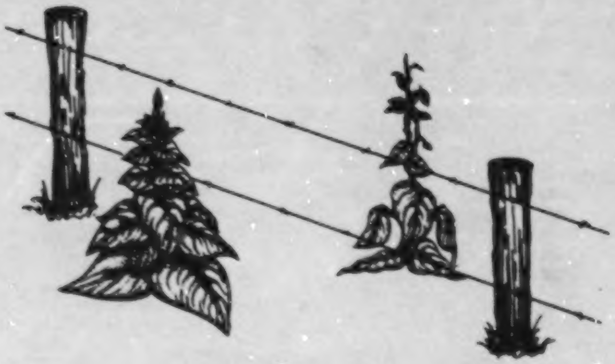
Desiccant

TM 4

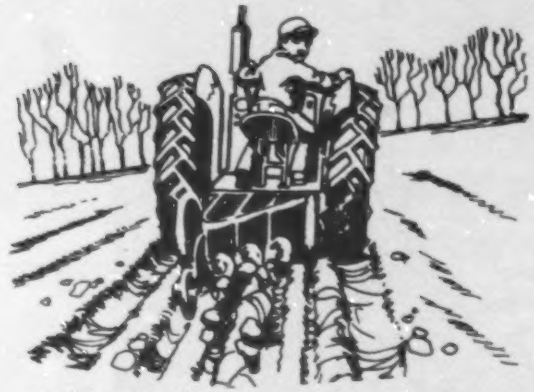
Alternate Control Methods



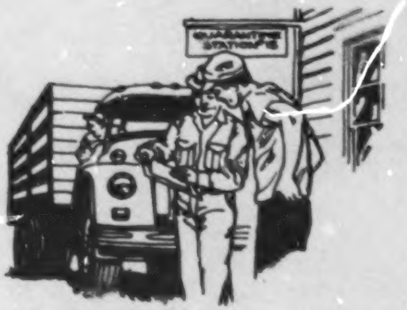
Biological Control



Resistant Varieties

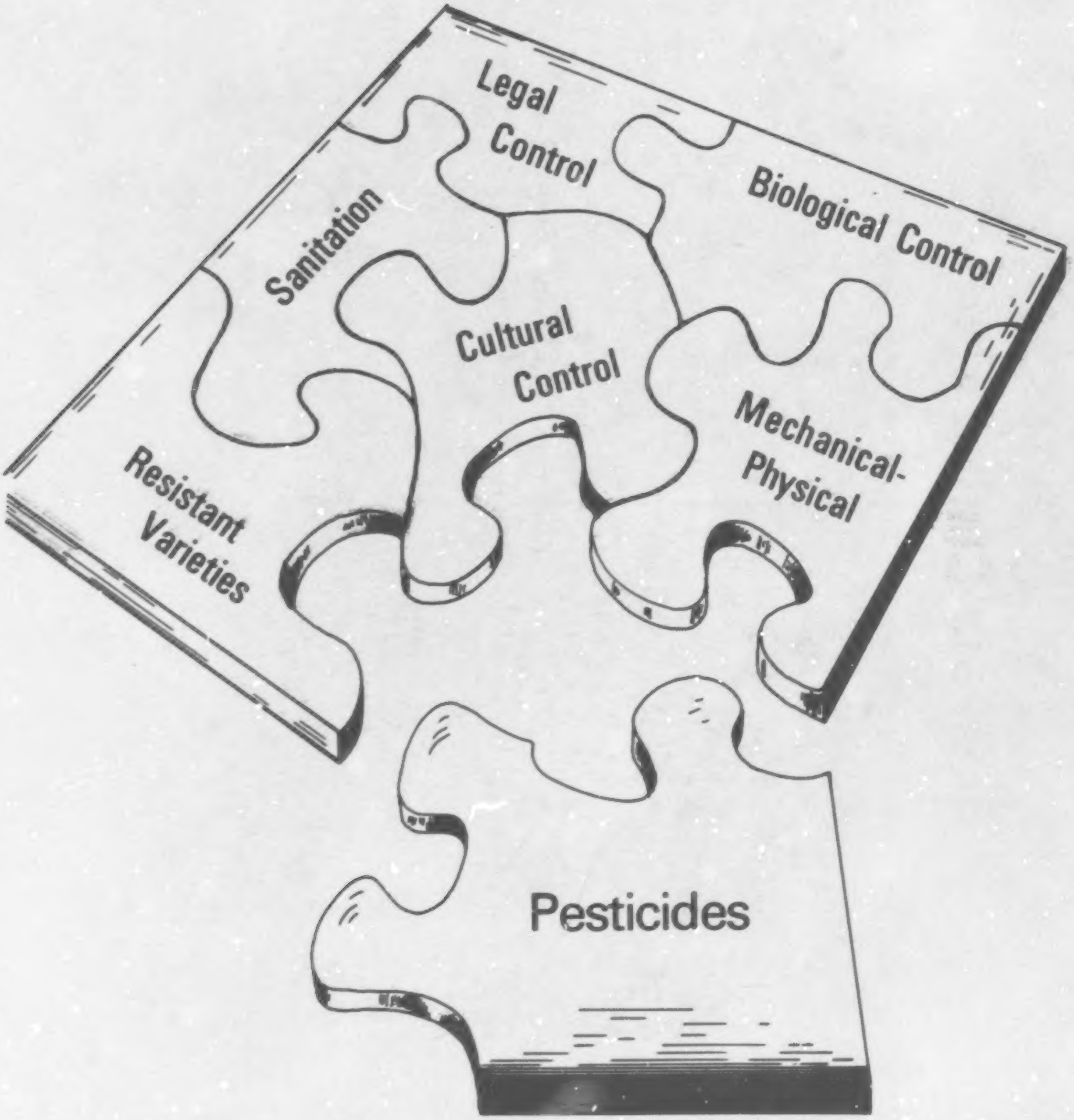


Cultural Control



Legal Control

Integrated Control


Legal Control
Biological Control
Sanitation
Cultural Control
Mechanical-Physical
Resistant Varieties
Pesticides

Future Pesticide Label

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS
(& DOMESTIC ANIMALS)
DANGER

ENVIRONMENTAL HAZARDS

PHYSICAL OR CHEMICAL HAZARDS

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling

RE-ENTRY STATEMENT
(if Applicable)

CATEGORY OF APPLICATOR

STORAGE AND DISPOSAL

STORAGE

DISPOSAL

CROP

RESTRICTED USE PESTICIDE

FOR RETAIL SALE TO AND APPLICATION ONLY BY CERTIFIED APPLICATORS OR PERSONS UNDER THEIR DIRECT SUPERVISION

PRODUCT NAME

ACTIVE INGREDIENT ______ %
INERT INGREDIENTS ______ %
TOTAL 100.00 %

THIS PRODUCT CONTAINS LBS OF PER GALLON

KEEP OUT OF REACH OF CHILDREN

DANGER — POISON

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED
IF INHALED
IF ON SKIN
IF IN EYES

SEE SIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS

MFG BY
TOWN, STATE
ESTABLISHMENT NO
EPA REGISTRATION NO

NET CONTENTS

CROP

CROP

CROP

CROP

CROP

WARRANTY STATEMENT

Ag IV - XII - 67

Existing Pesticide Label

SAMPLE LABEL — FRONT PANEL

NOMITE® 50W

Brand Name

Miticide

Wettable Powder Formulation
For Control of Plant-Feeding Mites

Common Name

Chemical Name

ACTIVE INGREDIENT	
Methylethylbutyl phos (metbutin)	50.0%
INERT INGREDIENTS	50.0%

E.P.A. Registration No. 1576-491
E.P.A. Establishment No. 1576-NC-1

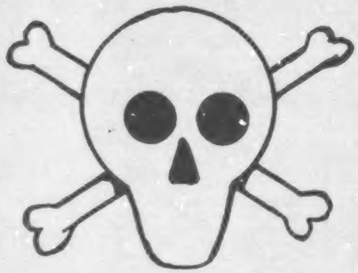
POISON **DANGER**

DANGER: KEEP OUT OF REACH OF CHILDREN
See other cautions on side panel

THE MOW CHEMICAL COMPANY
SNOWBALL, N.C. 27000

Signal Words

DANGER



POISON

Highly Toxic

WARNING

Moderately Toxic

CAUTION

Slightly Toxic to
Relatively Nontoxic

BEST COPY

BEST COPY

Future General Use Pesticide Label

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS

(CAUTION)

Harmful if swallowed. Avoid application directly to humans. Care should be taken to avoid inhalation of dust or spray mist, or prolonged contact with skin. In case of contact, immediately flush eyes or skin with large amounts of water. Get medical attention if irritation persists. Wear safety goggles or face shield when handling.

ENVIRONMENTAL HAZARDS

Keep out of lakes, streams, or ponds. Do not apply when weather conditions favor drift from target area.

DIRECTIONS FOR USE GENERAL CLASSIFICATION

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited. Pesticide, spray mixture, or rinsate that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticides or buried in a safe place away from water supplies. Containers should be disposed of in an incinerator or landfill approved for pesticide containers, or buried in a safe place. Consult Federal, State, or local disposal authorities for approved alternate procedures such as limited open burning.

DE WEED

HERBICIDE
WETTABLE POWDER

ACTIVE INGREDIENT: weedout · tri-azoic acid	80.0%
INERT INGREDIENTS:	20.0%
TOTAL:	100.0%

KEEP OUT OF REACH OF CHILDREN

CAUTION

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED Induce vomiting
IF INHALED Remove to fresh air.
IF IN EYES Flush eyes with plenty of water
IF ON SKIN Remove clothing and wash with detergent and water.

MFG BY A-Z CHEMICALS
Aster, Minnesota

EPA ESTABLISHMENT NO. 1357-MN-1
EPA REGISTRATION NO. 1357-41

DIRECTIONS FOR USE CONTINUED

DeWeed is for weed control in certain crops, ornamental plantings, on industrial sites, and around-the-farm. It should be applied before weeds emerge or following removal of weed growth. It controls a wide variety of annual broadleaf and grass weeds when used at selective rates in agricultural crops and ornamental plantings. When used at higher, non-selective rates in non crop areas, it also controls many perennial broadleaf and grass weeds.

GROUND APPLICATION: Use conventional spray equipment with 80° flat-fan nozzles. Screens in spray system should be no finer than 50 mesh. Use a pump with capacity to maintain 35-40 psi at nozzles. Use hydraulic or mechanical agitation during mixing and application to maintain a uniform suspension. Aerial application: Use only where specified in the use directions.

BLUEBERRIES and CANEBERRIES (blackberries, boysenberries, loganberries, raspberries)—Quackgrass. Apply 5 lbs per acre in the fall or split the application applying 2½ lbs per acre in the fall plus 2½ lbs per acre in the spring, when quackgrass is growing. Do not apply when fruit is present.

ALFALFA—Pure alfalfa less than one year old (Northeastern U.S. only)—Henbit, wild mustard, chickweed, alyssum, downy brome, wild oats, and pigweed. Pure alfalfa which has been seeded in the spring (before June 1) may be treated in the fall after the last cutting but before frozen ground conditions. Apply 1 lb. of De Weed per acre. For ground application apply in a minimum of 2½ gals. of water per acre.

GRASSES GROWN FOR SEED (Pacific Northwest only). Perennial ryegrass, tall fescue and fine fescues, such as Pennlawn, Chewings, Ranier, and related species. Control of broadleaf weeds and annual grasses including annual ryegrass, rattail fescue, silver hairgrass and downy brome. Apply 2½ lbs of De Weed in a minimum of 15 gals of water per acre as soon as fall rains start. Apply only to grasses from which at least one seed crop has been cut.

WEED CONTROL on industrial sites, highway medians, and shoulders, railroad rights-of way, lumber yards, and in non-crop areas on farms such as around buildings, fuel storage areas, along fences, roadsides, and lanes. Aerial application may be made where it is feasible. Use at least 1 gal of water for each 1 lb. of De Weed; use more water if practical for both ground and aerial application. To control annual broadleaf and grass weeds (including barnyard grass, cheat, crabgrass, lambsquarters, foxtail, ragweed, puncturevine and mullein), apply 6-12½ lbs. per acre. To control most annual and many perennial broadleaf and grass weeds (including quackgrass, bluegrass, redtop, burdock, Canada thistle, orchardgrass, dogfennel, and plantain), apply 12½-25 lbs. per acre. To control hard-to-kill perennial weeds (including bull thistle and sow thistle), apply 25-50 lbs. per acre.

NET WEIGHT FIVE POUNDS

Future Restricted Use Pesticide Label

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS

(DANGER)

Poisonous by swallowing or inhalation. Do not breathe spray mist. Do not get in eyes. Avoid contact with skin. Use only when wearing the following protective equipment and clothing. Wear tightly woven cotton overalls, waterproof hat, unlined neoprene gloves and boots. Wear safety goggles and/or face shield. Wear a mask or respirator jointly approved by the Mining Enforcement and Safety Administration and by the National Institute for Occupational Safety and Health. Before removing gloves, wash them with detergent and water. Always wash hands, face and arms with detergent and water before smoking, eating or drinking. For emergency assistance, call 000 000 0000

TO PHYSICIAN. De Pesto is a reversible cholinesterase inhibitor. Do not use oximes such as 2-PAM. Give Atropine 2 mg intravenously or subcutaneously. If in eye, instill one drop of Homatropine. Close supervision of the patient is indicated for at least 48 hours.

ENVIRONMENTAL HAZARDS

This pesticide is toxic to wildlife and fish. Use with care when applying in areas frequented by wildlife or adjacent to any body of water. Keep out of lakes, streams or ponds. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from target area. Do not contaminate water by cleaning of equipment or disposal of wastes.

PHYSICAL OR CHEMICAL HAZARDS

Flammable! Keep away from heat and open flame.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

RE ENTRY STATEMENT (IF APPLICABLE)

Do not enter within 48 hours after application.

CATEGORY OF APPLICATOR (IF APPLICABLE)

STORAGE AND DISPOSAL

STORAGE - Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited. DISPOSAL - Pesticide, spray mixture, or rinsate that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticides or buried in a safe place away from water supplies. Containers should be triple rinsed and offered for recycling, reconditioning, or disposed in approved landfill or buried in a safe place.

Consult Federal, State or local Disposal authorities for approved alternate procedures.

RESTRICTED USE PESTICIDE

FOR RETAIL SALE TO AND APPLICATION ONLY BY CERTIFIED APPLICATORS OR PERSONS UNDER THEIR DIRECT SUPERVISION

DE PESTO

INSECTICIDE
EMULSIFIABLE CONCENTRATE

ACTIVE INGREDIENT: pestoff—tri-salicylic acid	45.0%
INERT INGREDIENTS:	55.0%
TOTAL:	100.0%

THIS PRODUCT CONTAINS 4.0 LBS OF PESTOFF PER GALLON

KEEP OUT OF REACH OF CHILDREN

DANGER — POISON

STATEMENT OF PRACTICAL TREATMENT

IF SWALLOWED - Induce vomiting by giving a tablespoonful of salt in a glass of warm water. Repeat until vomitus is clear. Call a physician immediately.

IF INHALED - Remove to fresh air. Call a physician immediately.

IF IN EYES - Flush eyes with plenty of water for at least 15 minutes. Call a physician immediately.

IF ON SKIN - In case of contact, remove contaminated clothing and immediately wash skin with detergent and water.

SEE SIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS

MFG BY A-Z CHEMICALS
CHEMTON, NEVADA

EPA EST. NO. 1357-NV-1
EPA REGISTRATION NO. 1357-42

NET CONTENTS ONE GALLON

DIRECTIONS FOR USE CONTINUED

METHODS OF APPLICATION. The minimum gallonage requirement is 10 gallons of finished spray per acre with ground equipment, 2 gallons per acre with aircraft.

ALFALFA. Air and Ground Application—Alfalfa Weevil Larvae, Egyptian Alfalfa Weevil Larvae, Pea Aphid, and in New York state for Snout Beetle control. Apply the amount of De Pesto indicated in the chart, when feeding is noticed or when insects appear. Alfalfa Weevil Adult—Apply 1-2 pints per acre when insects appear. Lygus Bugs—Apply 2 pints per acre prior to bloom. Observe the indicated number of days after application before cutting or grazing. Do not apply more than once per season. Apply only to field planted to pure stands of Alfalfa.

Pints of De Pesto Per Acre	Do Not Cut or Graze Within
½	7 days
1	14 days
2	28 days

CORN, FIELD. Ground Application—Corn Rootworms—Use 1½ pints of De Pesto per 13,000 linear feet (1 acre with 40 inch spacing). Apply at planting, as a 7 inch band over the row or inject on each side of the row by mixing with water or liquid fertilizers. When De Pesto is used with liquid fertilizers, mix in the following way making sure that the mixture is physically compatible. Premix 1 part of De Pesto with 2 parts of water. Add this premix to the tank of fertilizer along with rinsings from the premixing container. Maintain agitation in the tank after mixing and during application. Do not mix until ready to use.

SUGARCANE. Sugarcane Borer—Apply 1-1½ pints De Pesto per acre using ground or aerial equipment. Check sugarcane fields weekly, beginning in early June and continuing through August. Make first application only after visible joints form and 5% or more of the plants are infested with young larvae feeding in or under the leaf sheath and which have not bored into the stalks. Repeat whenever field checks indicate the infestation exceeds 5%. Do not apply within 17 days of harvest. Do not use in Hawaii.

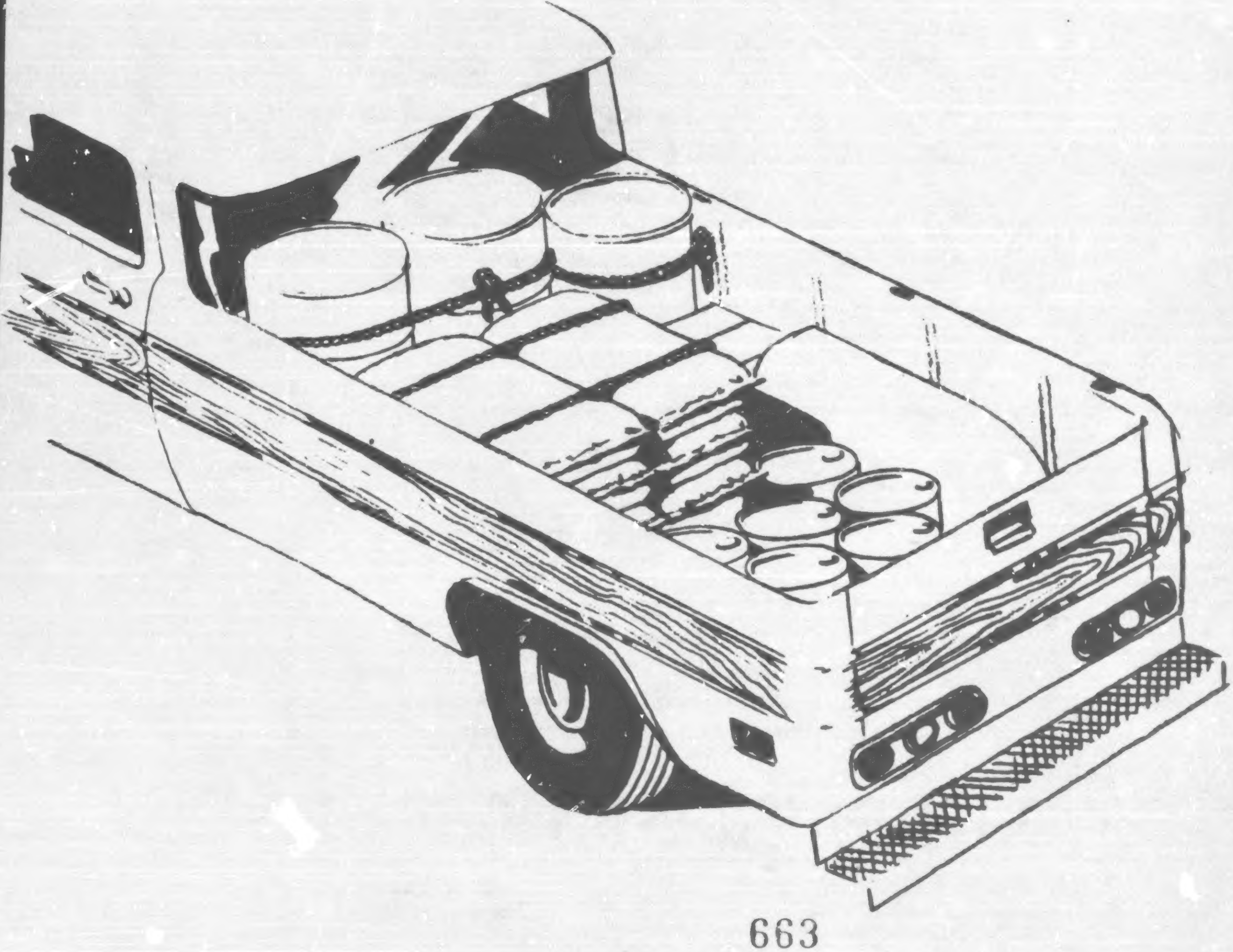
ORANGES, LEMONS, GRAPEFRUIT, and TANGELOS in Arizona and California. Air and Ground application—Citrus thrips—Apply De Pesto at ½ to 1 lb. per acre. Use sufficient water to obtain thorough coverage (5 to 15 gals/acre by air). Use the higher rate on severe infestations of thrips. Apply in the early spring before bloom when the new growth is about 3 to 4 inches long. Make additional applications as needed until the new fruit is walnut size. Application at petal fall may be critical to prevent fruit scarring. Applications during mid-summer to protect new growth on young trees are also recommended.

Do not apply within 3 days of harvest. Do not graze livestock in treated orchards for 10 days after treatment.

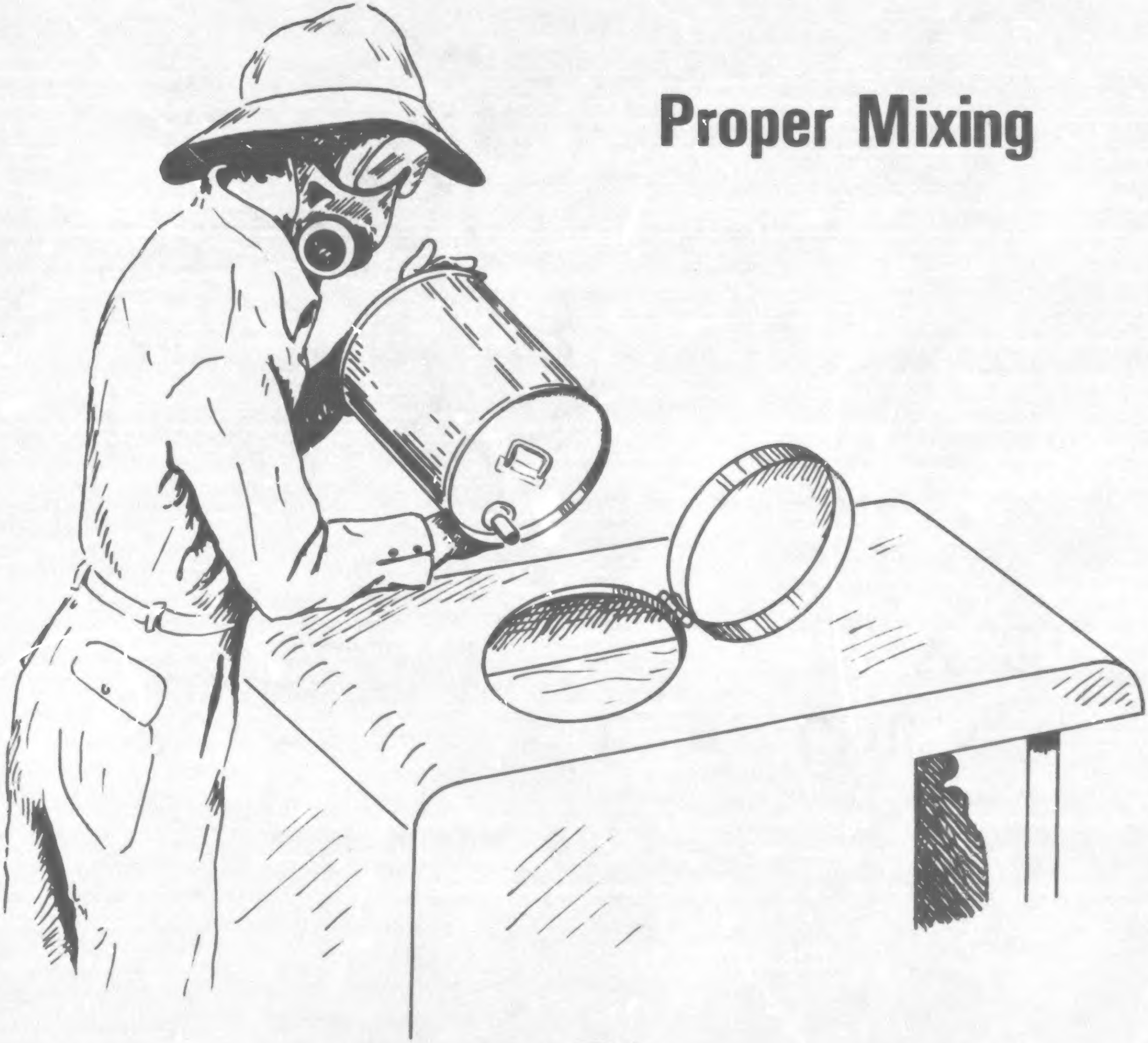
POTATO. Tuberworm, cabbage looper, aphids, and in areas east of the Mississippi River, leafhoppers and flea beetles. Apply De Pesto at indicated rates when field checks indicate the insect infestation is above 5%. Tuberworm, cabbage looper and aphid—apply ½ to 1 lb. per acre. Leafhopper and flea beetles—apply ½ lb per acre. Do not apply within 14 days of harvest.

BEST COPY

Securing Containers

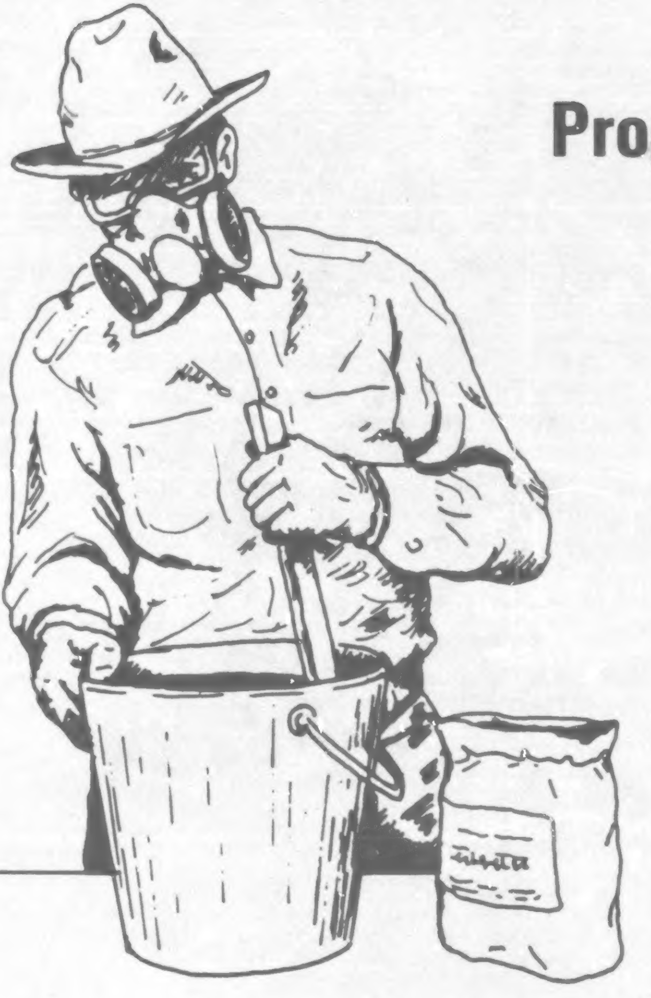


Proper Mixing



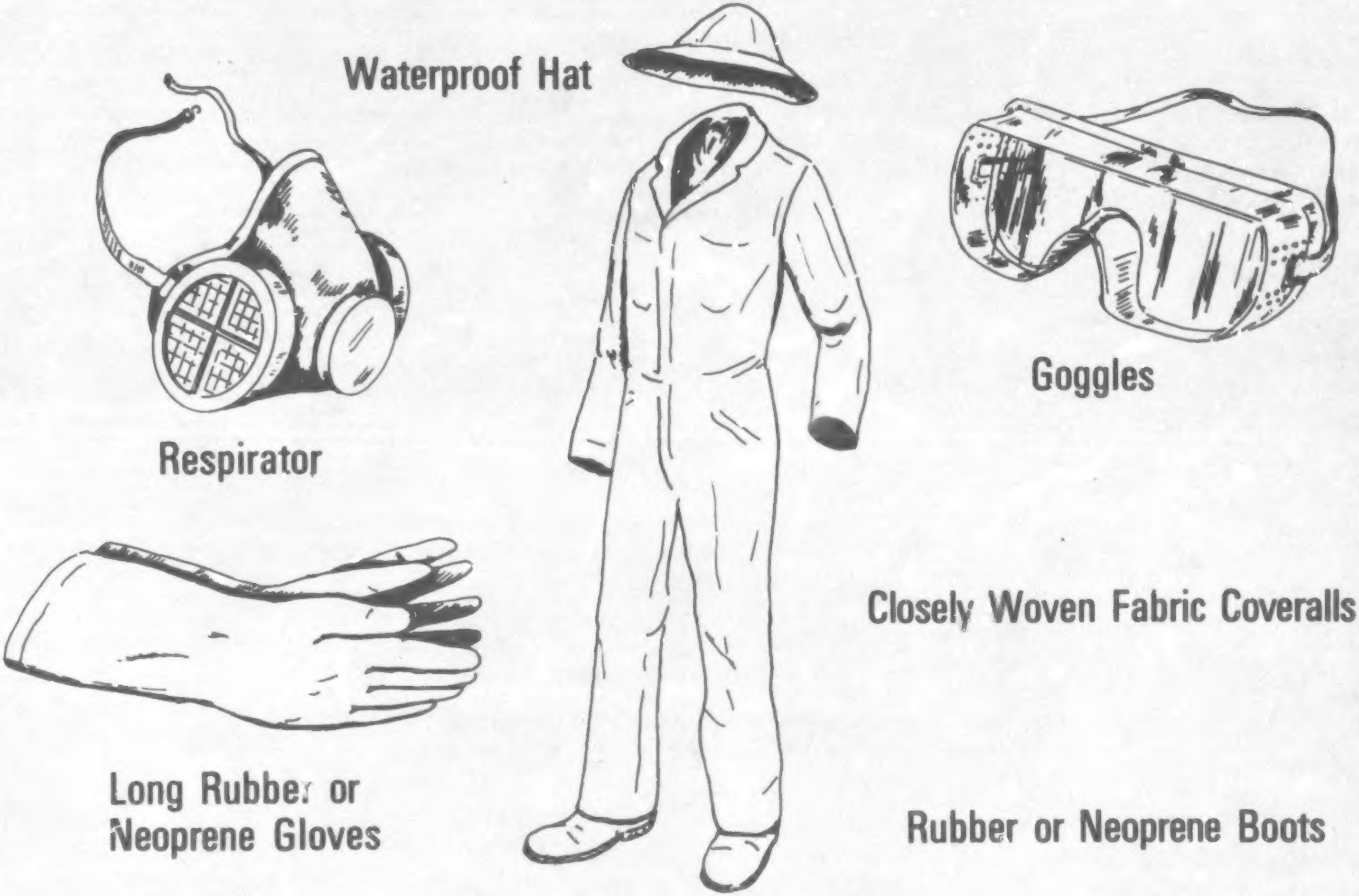
Ag IV - XII - 73

TM 2

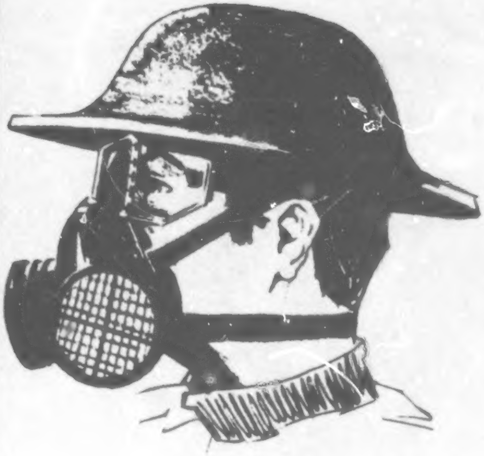


Proper Clothing for Mixing

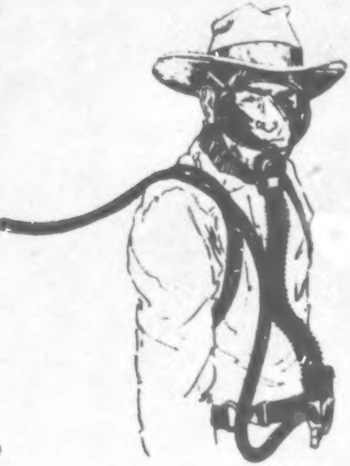
Protective Clothing and Equipment


Waterproof Hat
Respirator
Goggles
Closely Woven Fabric Coveralls
Long Rubber or Neoprene Gloves
Rubber or Neoprene Boots

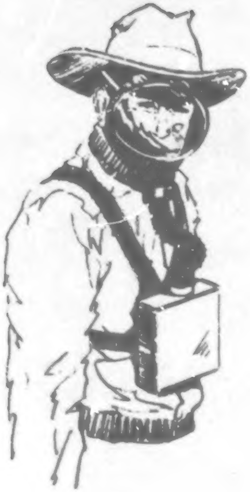
Types of Respirators



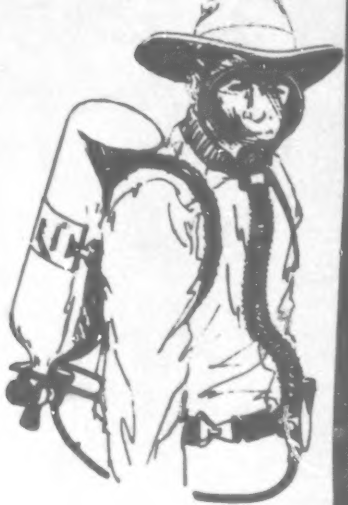
Cartridge



Supplied Air



Cannister



Self-contained

Types of Formulations

Dry

Dust (D)

Poisonous Bait (B)

Granule (G)

Wettable Powder (WP or W)

Soluble Powder (SP)

Liquid

Low Concentrate Solution (S)

Emulsifiable Concentrate Solution (EC or E)

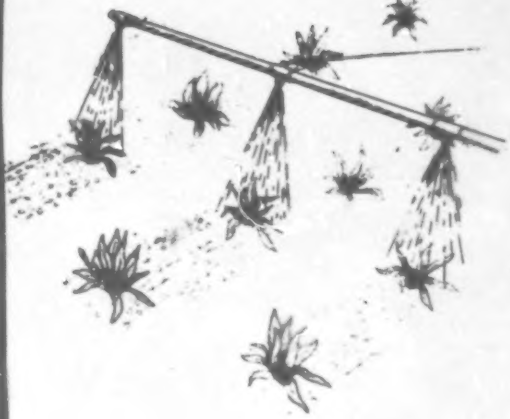
Ultra-Low Volume Concentrate Solution (ULV)

Flowable (F)

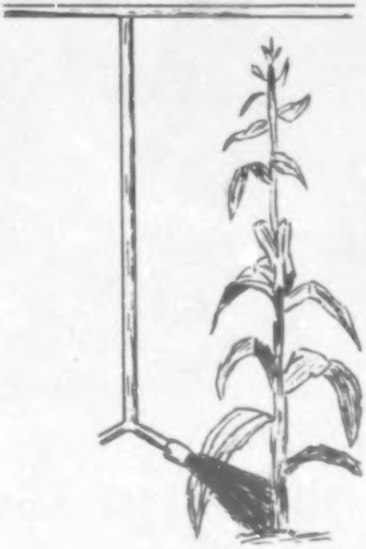
Gas

Fumigant

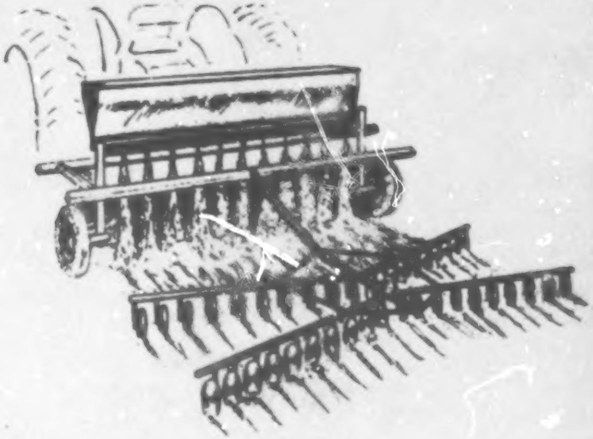
Methods of Application



Band



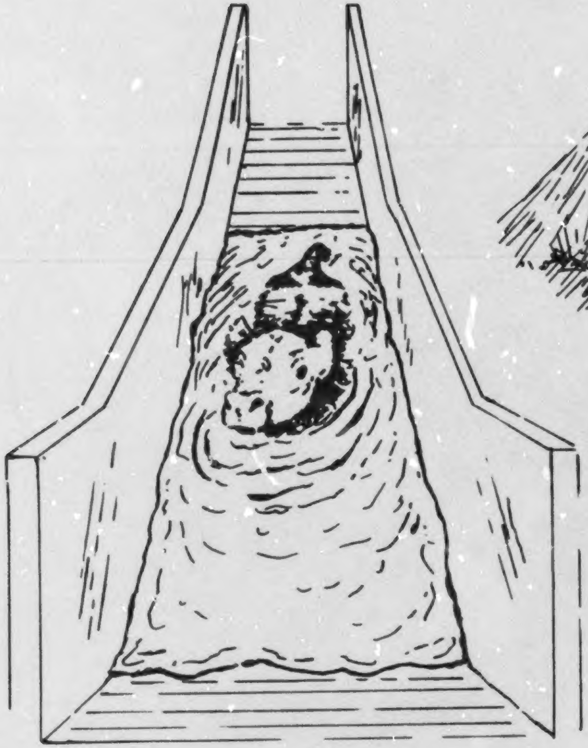
Directed



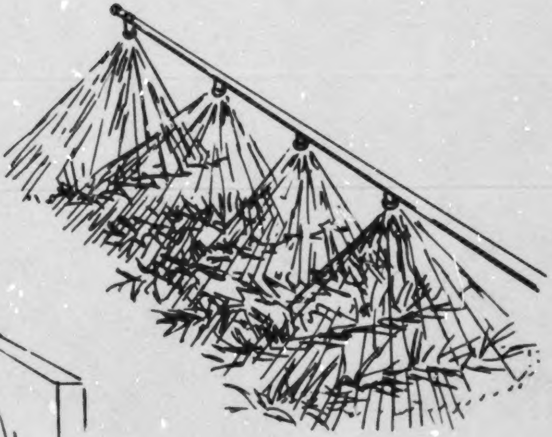
Soil Incorporation

Methods of Application

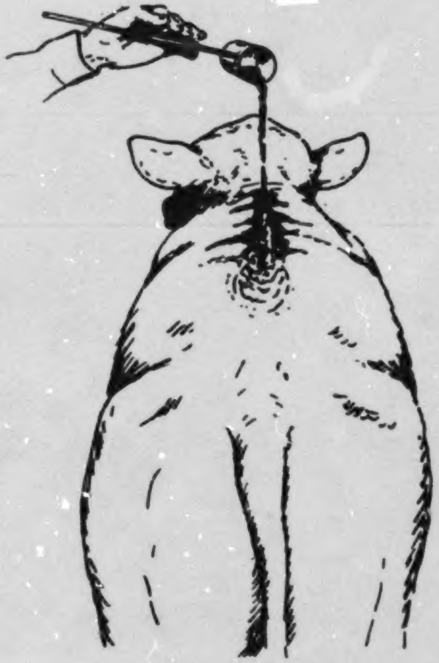
(Continued)



Dipping

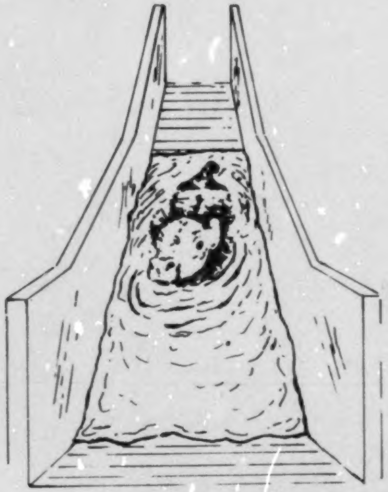


Broadcast

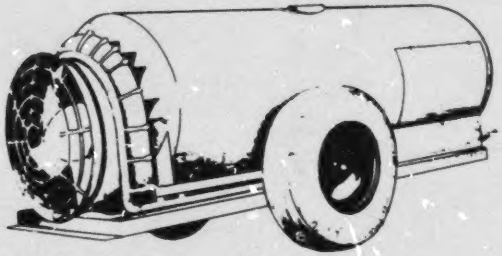


Pour-On

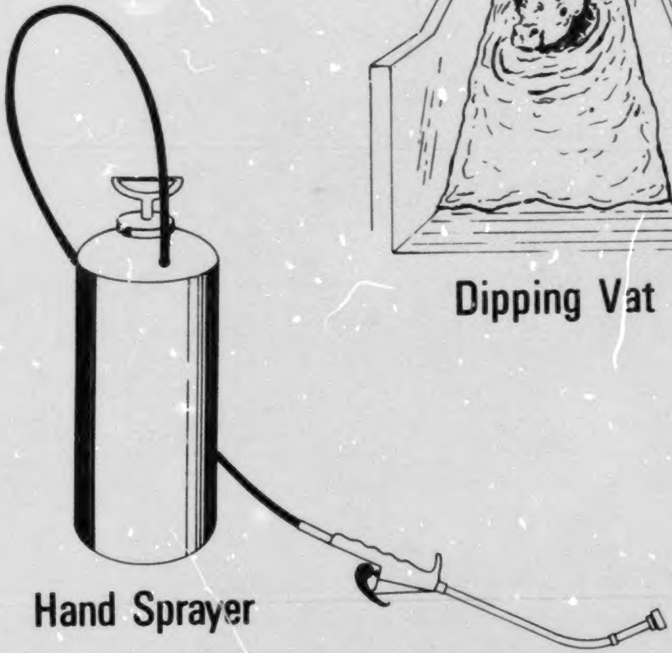
Types of Pesticide Application Equipment



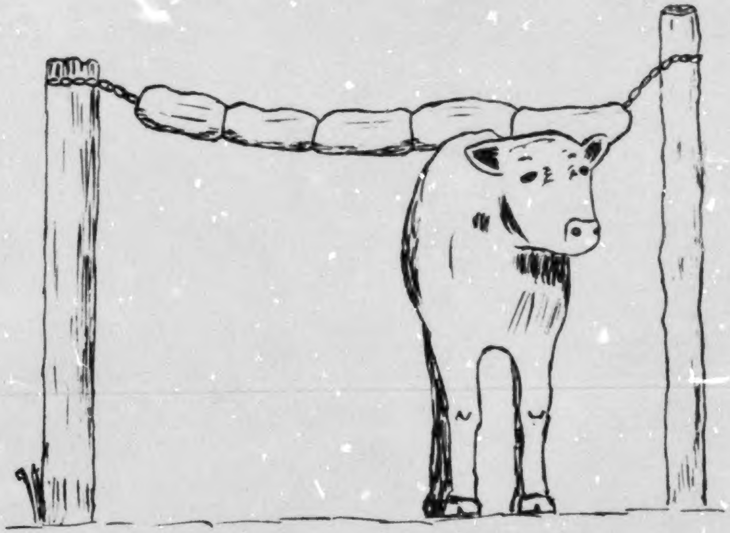
Dipping Vat



Air Blast Sprayer
or Mist Blower



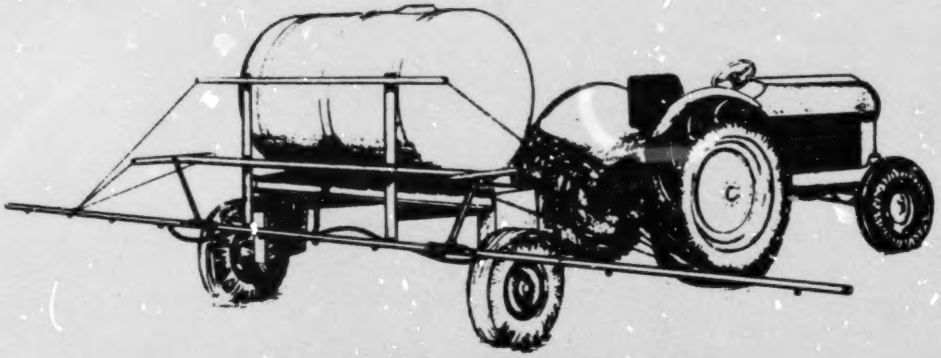
Hand Sprayer



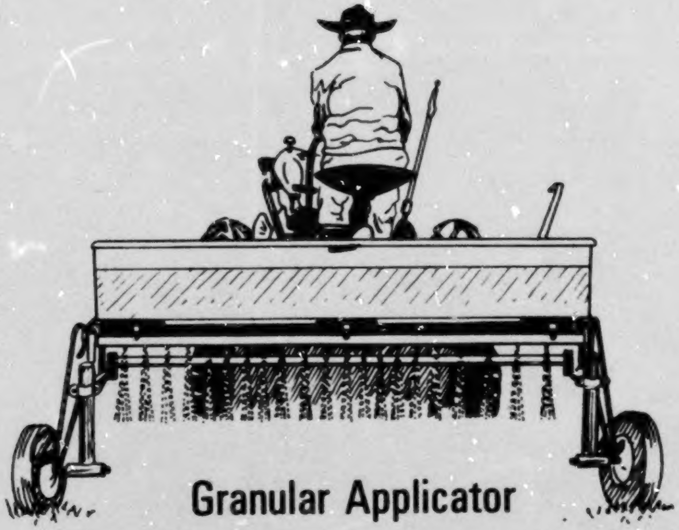
Back Rubber

Types of Pesticide Application Equipment

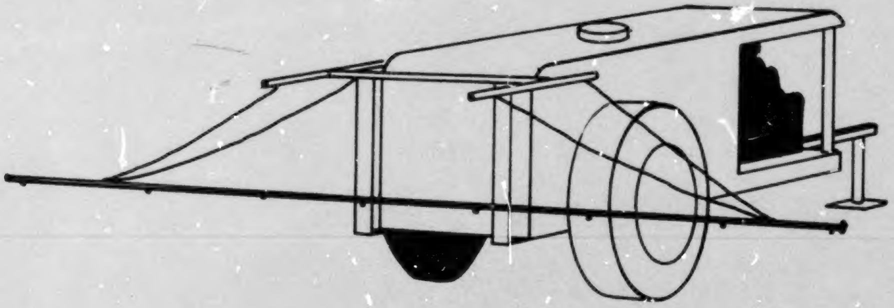
(Continued)



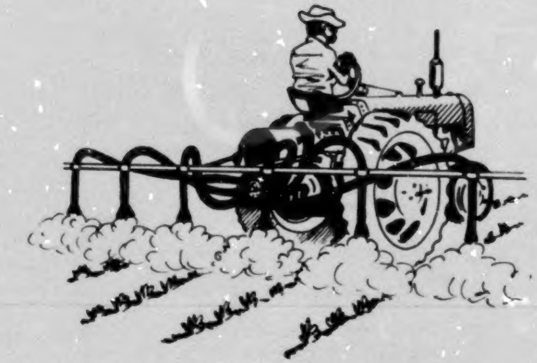
Low Pressure Field Sprayer



Granular Applicator



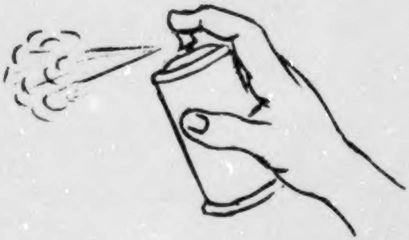
High Pressure Field Sprayer



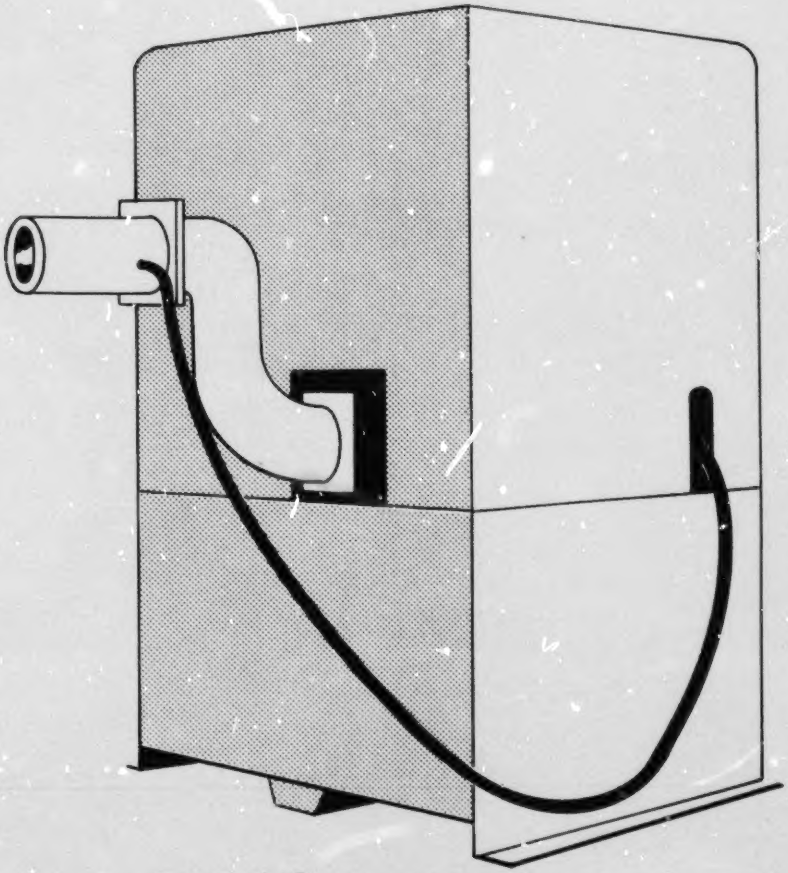
Power Duster

Types of Pesticide Application Equipment

(Continued)

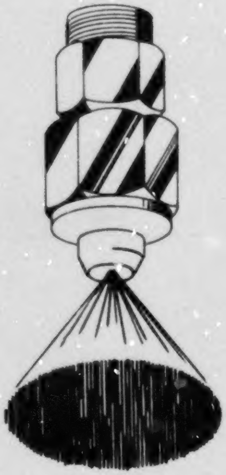


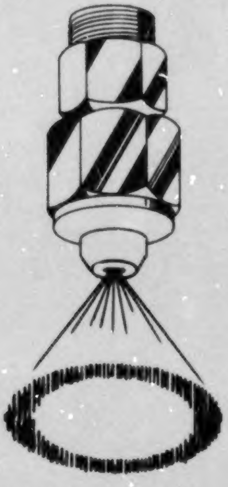
Aerosol Bomb

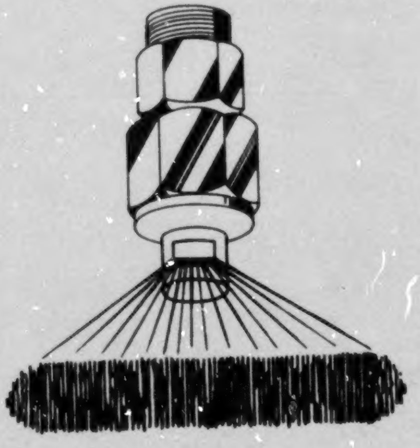


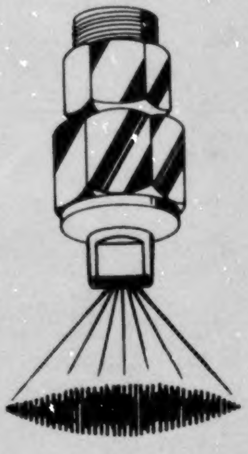
Aerosol Generator

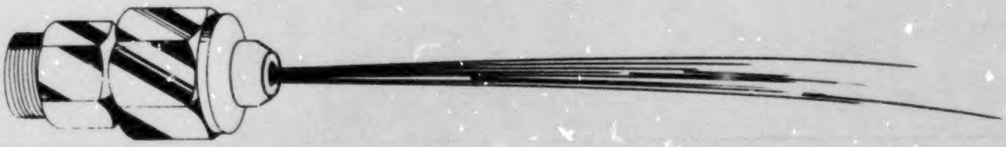
Types of Nozzles


Solid (Full)
Cone Nozzle

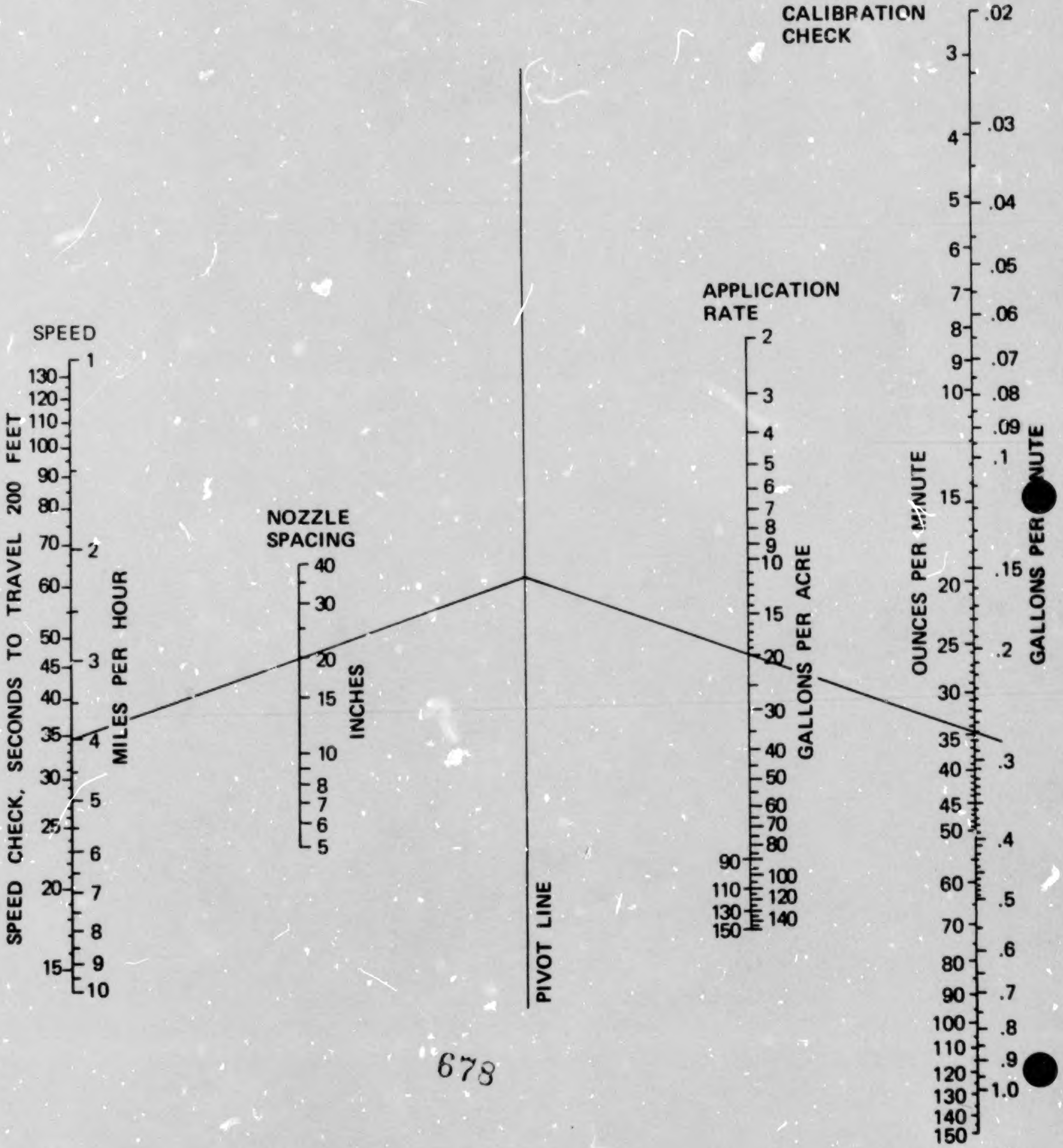

Hollow
Cone Nozzle


Flooding Flat
Fan Nozzle


Regular Flat
Fan Nozzle

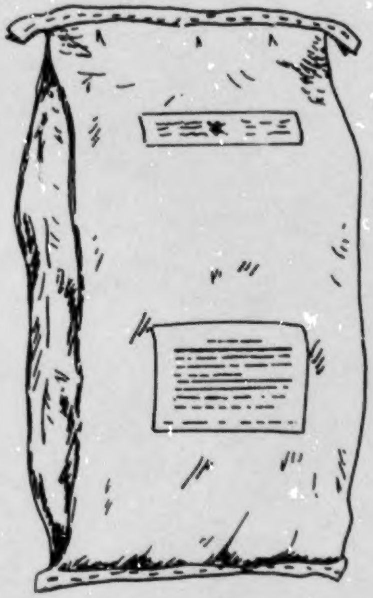

Solid Stream Nozzle

Sprayer Calibration Nomograph

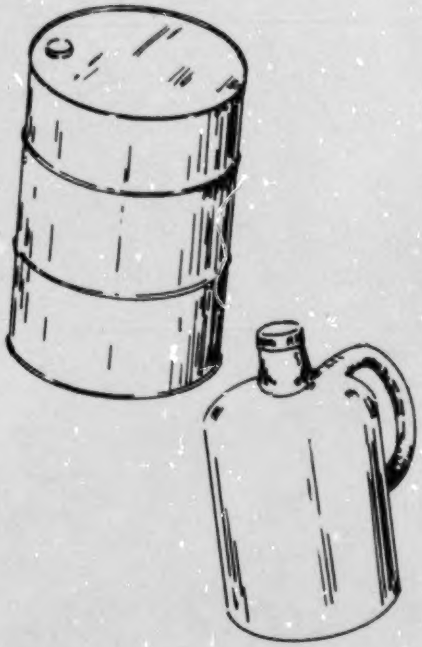


Container Classification

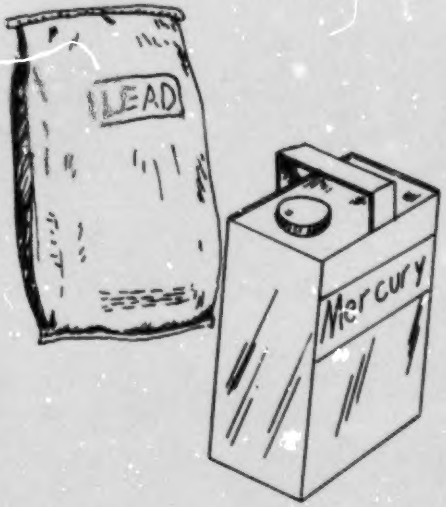
Burnable



Nonburnable



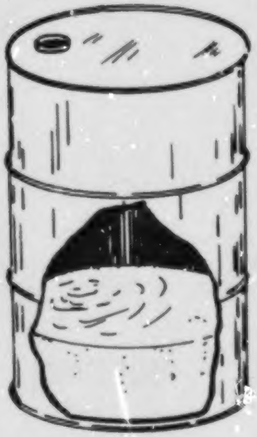
Mercury, Lead, Arsenic
Cadmium and
Inorganic Pesticides



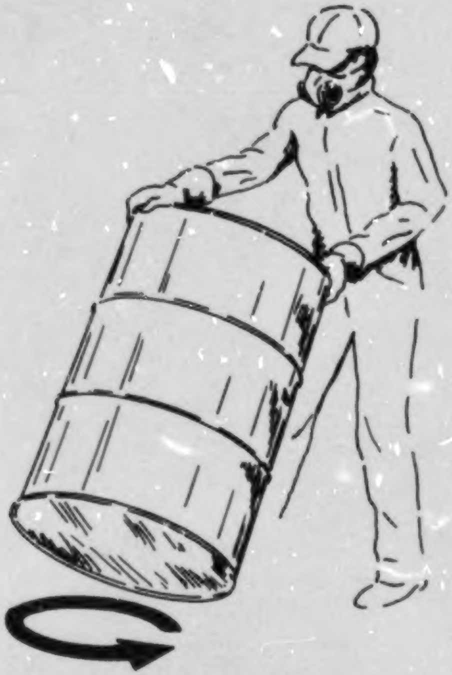
Ag IV - XII - 85
TM 1

Rinsing Drums

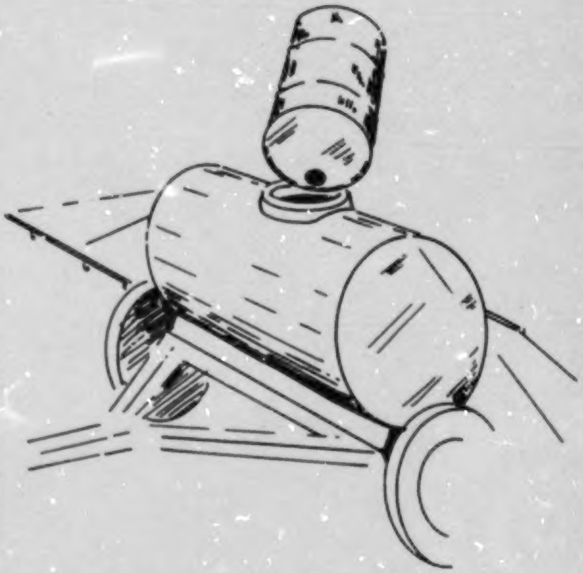
Rinse and Drain - Three Separate Times



Fill 50 Gallon Drum ¼ Full



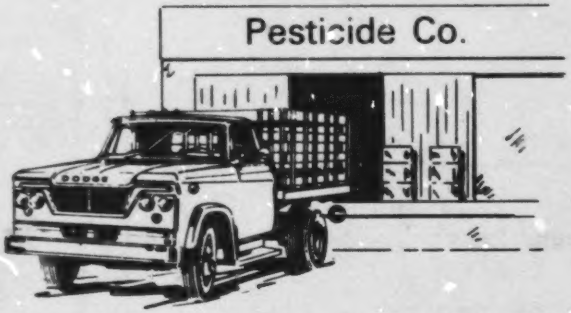
Rotate With Lip on Ground



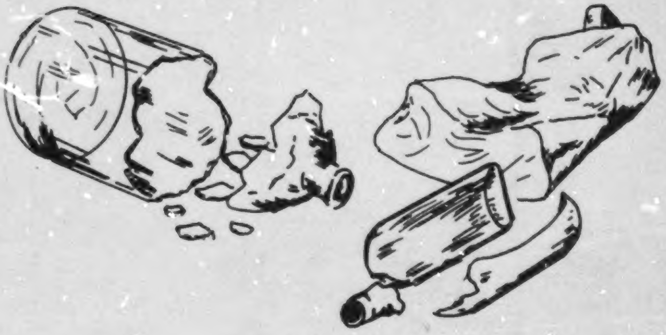
Drain Into Spray Tank

Disposal of Containers

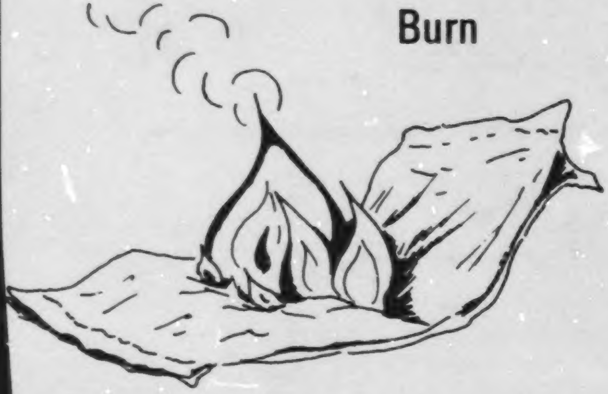
Recycling


Pesticide Co.

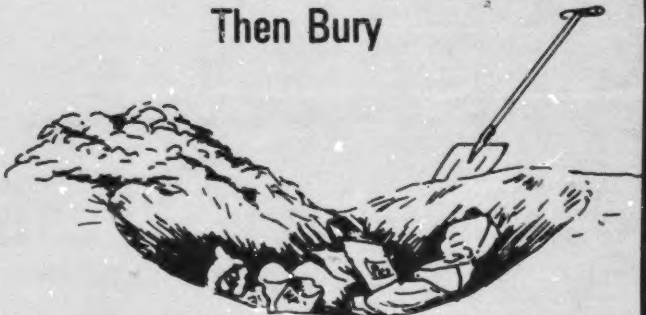
Break, Crush, or Cut Apart



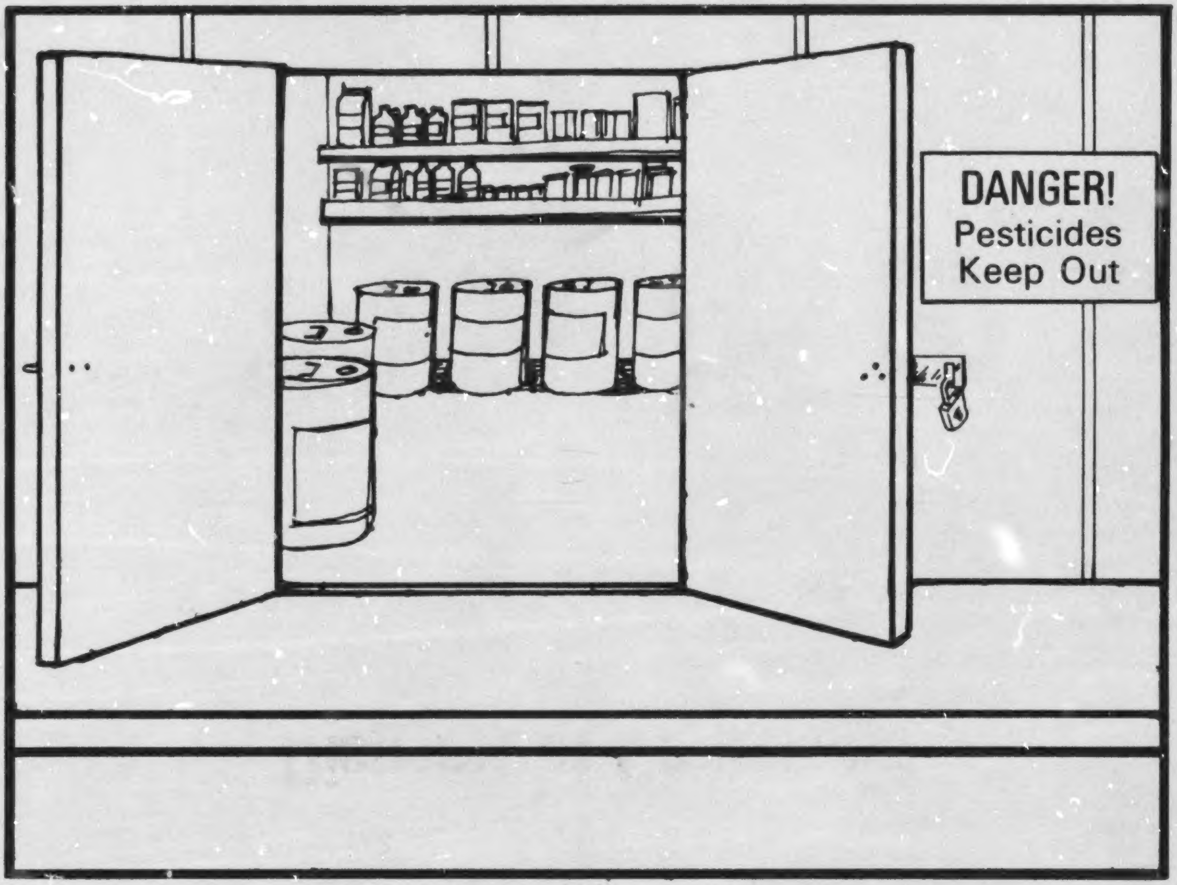
Burn



Then Bury



Storage Area


DANGER!
Pesticides
Keep Out

Agricultural Building Construction

Instructor's Guide:

1. The best reference currently available for teaching Agricultural Building Construction is "Utility Buildings" by AAVIM. Order AAVIM materials at the following address:

   OSU Extension Stock Room
   Extension Hall
   Oregon State University
   Corvallis, Oregon 97331

2. "Utility Buildings" is a good general guide that can be used to provide basic information and guidance for construction of agricultural buildings.

3. If you need to get into design or partial designs (i.e., increased header strength to support a block and tackle), use "Practical Farm Buildings" as a guide. "Practical Farm Buildings" was written by James Boyd and is published by Interstate Printers & Publishers, Inc., Danville, Illinois 61832.

4. A complete concrete and masonary text with excellent instructional materials and excercises is "Concrete and Concrete Masonry." This text is written by Ahrens, Hoerner and Bear and published by Hobar Publications, 1305 Tillar Lane, St. Paul, Minnesota, 55112.

5. An excellent rafter booklet is "Rafter Layout" written by Bear and Hoerner and published by Hobar Publications.

6. If you are going to be building your own trusses get a copy of "Designs for Glued Trusses" a Midwest Plan Service Publication available at the Oregon State University, Agricultural Engineering Extension Publications Office, Gilmore Hall, Oregon State University, Corvallis, Oregon 97331.

7. The materials included in this unit provide instruction in the areas of:

   a. Determining Bills of Materials
   b. Concrete & Masonry Block Work
   c. Metal Roofing & Sliding for Farm Structures
   d. Applying Asphalt Roofing and Siding Products

*Note: Use "Utility Buildings" by AAVIM for a text. Use the entire book, each section has valuable information.

*Note: Have the class build a small building to put into practice the theory that is taught. Keep the students actively doing something to avoid senioritis in the classroom.

Objectives:

Upon completion of this unit, the student will be able to:

1. Write a bill of materials for a small building.
2. Select materials appropriate for construction of a small building considering both construction quality and price of materials.
3. Follow construction specifications in the construction of a small agricultural structure.
4. Properly build a small agricultural structure to live load, dead load and wind load specifications.
5. Fasten construction materials corrected to achieve a lasting structure.

References:

1. Modern Agriculture Mechanics
T. J. Wakeman
Interstate Printers and
Publishers, Inc.
Danville, Illinois 61832

2. Utility Buildings
The American Association for
Vocational Instructional Materials
120 Engineering Center
Athens, Georgia 30602

Agriculture Building Construction

Unit I: Determining Bills of Materials (2 hours)

Suggested Procedure and Activities: Miniature buildings and equipment will be helpful in explaining the dimensions of materials. Transparencies may also be used as a teaching aid.

1. Why It Is Important to Know How to Figure a Bill of Materials.

   The agricultural builder usually thinks about the cost of a new building or a piece of equipment before a completed sketch is sent to the drawing board. The cost is partially determined by a bill of materials.

   a. A complete bill of materials will show the kinds of material required, the dimensions of materials, and the amount of each kind needed.

      Plans for buildings and equipment are usually accompanied by a list of materials. If an adequate bill of materials does not accompany the construction plans, a list should be made before initiating the building program. A bill of materials will reduce waste of materials and save time. For example, lumber may be purchased at the desired dimensions, steel at the desired length, and concrete at the proper number of cubic yards needed for a job. If lumber or metal roofing is too long, it must be cut to the proper length. This may result in waste.

2. The Meaning of a Bill of Materials.

   A bill of materials gives the number of pieces, dimensions of each piece, kind and amount of material, and, in some cases, where the material is to be used. A list of materials for a farm pole building may include poles, lumber, concrete or gravel, metal roofing, nails, and hardware. Simply stated, a bill of materials is a list of materials which gives the amount, size, and kind to be used on a specific construction project.

3. How to Prepare a Bill of Materials.

   A working sketch usually contains a very simple set of specifications for a given job or project. If a large piece of equipment or a building is constructed or repaired, a set of specifications supplementing the drawing will give a bill of materials necessary for the job. The following procedure may be followed in preparing a bill of materials:

a. Study the sketch or drawing (plan) of the building or piece of equipment.

b. Develop a list of materials that will be used first and then make a detailed list needed for the job.

c. Revise the detailed list by making a bill of materials in standard sizes. List the amount of the material for each stock, size, and give its description or use.

d. Attach the list of materials to the sketch or drawing for future reference.

4. The Unit of Measure for Bill of Materials.

a. Board Foot - A board foot is a piece of lumber one foot long, one foot wide, and one inch thick. Most lumber is sold by the board foot or by the 1000 board feet and grade classification.

b. Running Foot - A running foot is a piece of material one foot long regardless of width and thickness. Molding, narrow finished lumber (1" x 2"), most pipe used in plumbing, electrical wire, fencing materials, molding materials, certain kinds of metal roofing, and certain types of reinforcement steel are sold by the running foot. A running foot measure is sometimes referred to as line or measure.

c. Square Foot - A square foot is one foot long and one foot wide regardless of the thickness. Wall and floor tile, plywood and other paneling, concrete slabs, metal roofing, plastic materials, and floor covering (linoleums) are usually sold by the square foot. Some masonry materials are sold on the basis of covering a certain number of square feet.

d. Cubic Foot - A cubic foot is one foot wide, one foot long, and one foot high. Cement and some other masonry materials are sold by the cubic foot.

e. Cubic Yard - A cubic yard is 27 cubic feet. It is one yard (3 feet) on all sides. Sand, gravel, fill dirt, and concrete may be purchased by the cubic yard.

f. Gallon - A gallon is a liquid measure. Paint and painting materials are usually sold by liquid measure. The weight of a gallon of paint is determined by its ingredients. A given quantity of paint is supposed to cover a certain number of sqaure feet.

g. Roll - A roll is something that is rolled into a cylinder or ball. Wire fencing, roofing paper, and certain types of roofing may be purchased by the roll.

h. Square - A square is a term used in roofing. It is 10 feet, or 100 square feet. For example, three bundles of asphalt shingles will cover 100 square feet, and a square of metal roofing will cover 100 square feet.

5. Figuring a Bill of Materials.

a. Permanent - type hog shed with 12 by 16 feet roof.

Bill of Materials

Transparency V-A-3, No. 1

Use Drawing "Hog Lot Equipment" B 2192 P. 10

Item No.	Quantity	Material	Description
A	2	5" top x 12'0"	Treated Posts
A	2	5" top x 10'0"	Treated Posts
B	4	2" x 6" X 12'0"	No. 2 Yellow Pine Rafters
C	5	2" x 6" x 16'0"	No. 2 Yellow Pine Purlins
D	1	2" x 6" x 10'0"	No. 2 Yellow Pine Blocking
E	1	1" x 6" x 14'0"	No. 1 Yellow Pine Diagonal Brace
F	4	5/8" x 8"	Carriage Bolts
G	8	2'2" x 12'0"	28 Gauge Galvanized Roofing
	5 bls.	Nails	Metal Roofing Common Nails

Determining Cost of Shed

The four posts are sold according to the top diameter and the length.

All lumber for the shed is sold by the board foot. For example,

$$\frac{4 \text{ pc} \times 2'' \times 6'' \times 12'0''}{12} = 48 \text{ Board Feet.}$$

The bolts are sold according to diameter and length, and the nails are sold per pound.

Quantity	Material	Cost	Total Cost
2	5" x 12'0" Posts	5.50	$11.00
2	5" x 10'0" Posts	4.50	9.00
4	2" x 6" x 12'0"	240.00 per M	11.52
5	2" x 6" x 16'0"	240.00 per M	19.20
1	2" x 4" x 10'0"	180.00 per M	1.20
1	1" x 6" x 14'0"	180.00 per M	1.26
4	5/8" x 8" Bolts	.45	1.80
*8	2'2" x 12'0" Roofing	15.00 per sq.	31.20
5 lbs.	Roofing Nails	.20	1.00
4 lbs.	16 D Common Nails	.18	.72
	Total Cost Less Labor		$87.90

*A square of metal roofing is the actual amount of metal, disregarding any overlap. For example,

$$\frac{8 \text{ pc} \times 26'' \times 12'0''}{144} = 208 \text{ sq. feet}$$

208 sq. ft. x $15.00 per sq. = $31.20
(100 square feet equals one square.)

Transparencies Nos. 1, 2, 3, 4, 5, and 6

b. Multi-purpose pole building - 30 by 60 feet.

A multi-purpose building may be used to store equipment, supplies, hay and other livestock feed, feed livestock, and provide shelter for livestock. The following view and bill of materials are necessary in order to facilitate the construction of the multi-purpose pole building:

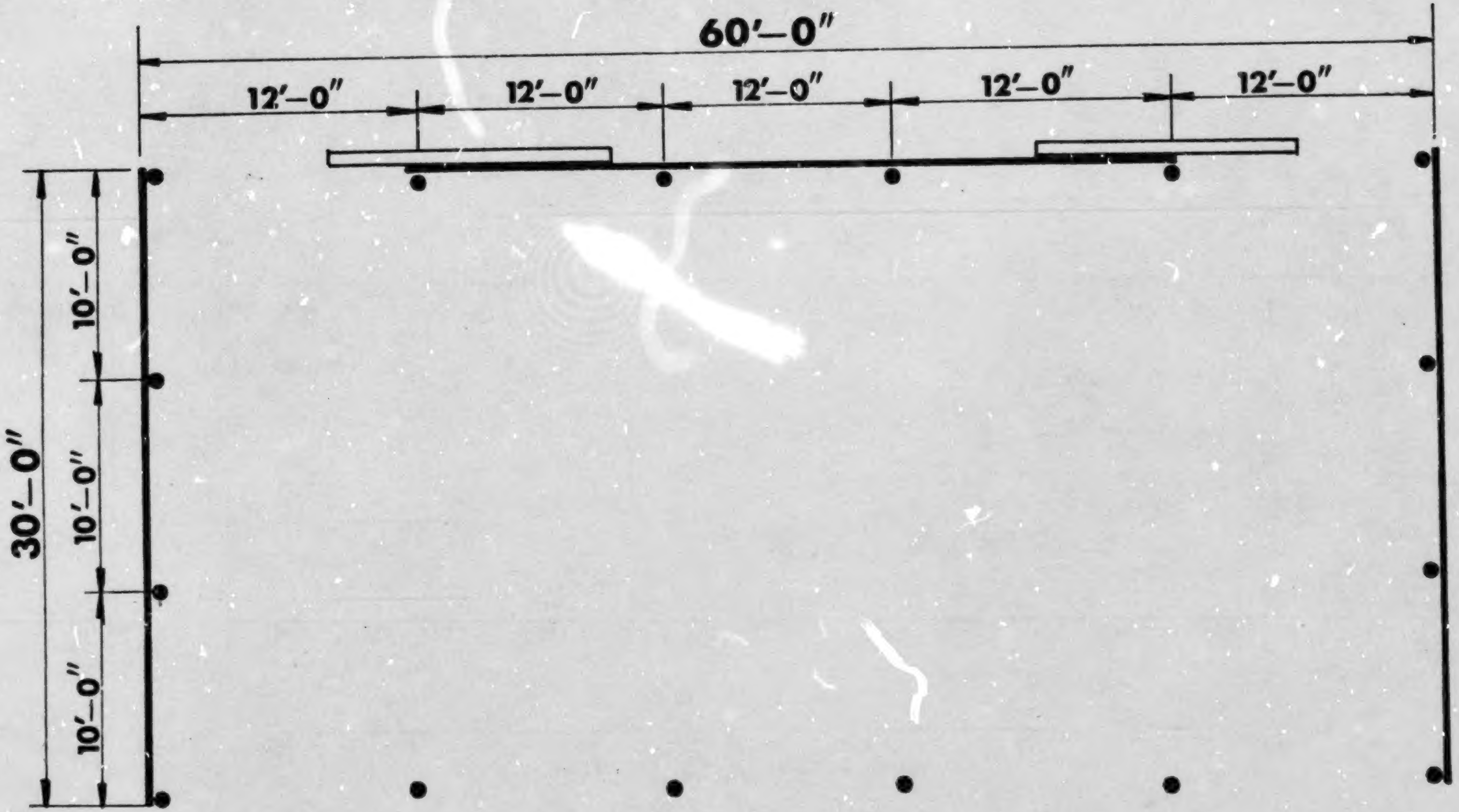
Plan View
Sectional View
Detail Views
Perspective View

If an equipment area is to be provided in one end of the barn, a concrete floor 14'0" by 30'0" - 1 - 2 - 3 mixture 4" thick should be constructed. The amount of ready mix to order is determined in the following manner:

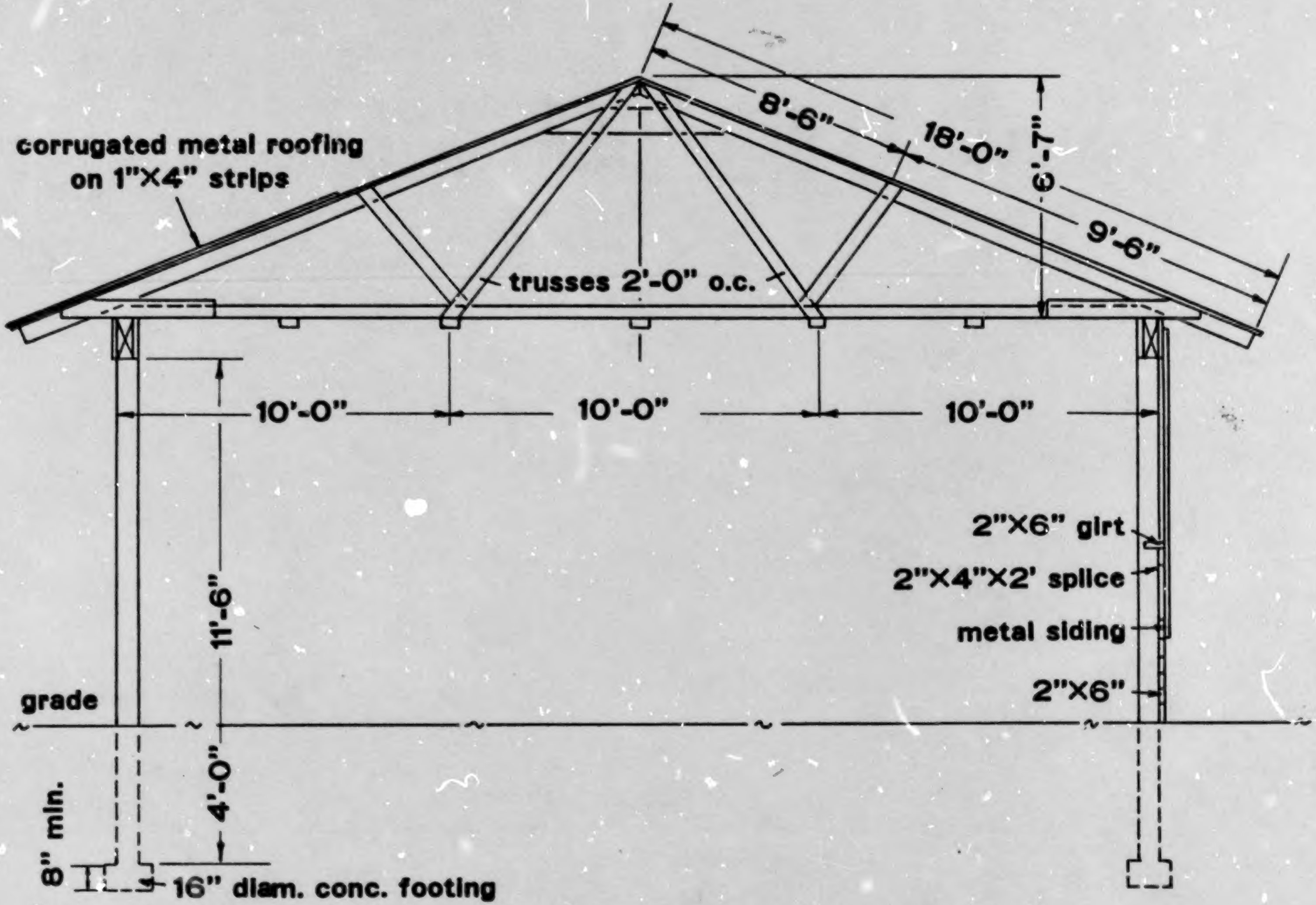
Measure the floor area (length times width times thickness) to determine the volume in cubic feet and divide by 27. There are 27 cubic feet of concrete in one cubic yard of mixture.

$$\frac{14 \times 30 \times 1/3}{27} = 5.18 \text{ cubic yards of concrete}$$

Between 5 and 10 percent more ready mix concrete should be ordered than is figured by the formula. Example: 5 percent of 5.18 = .2590; .2590 + 5.18 = 5.43; therefore, 5 1/2 cubic yards should be ordered to pour the floor. If concrete is $17.50 per cubic yard, then the cost of materials for the entire floor will be $96.25.

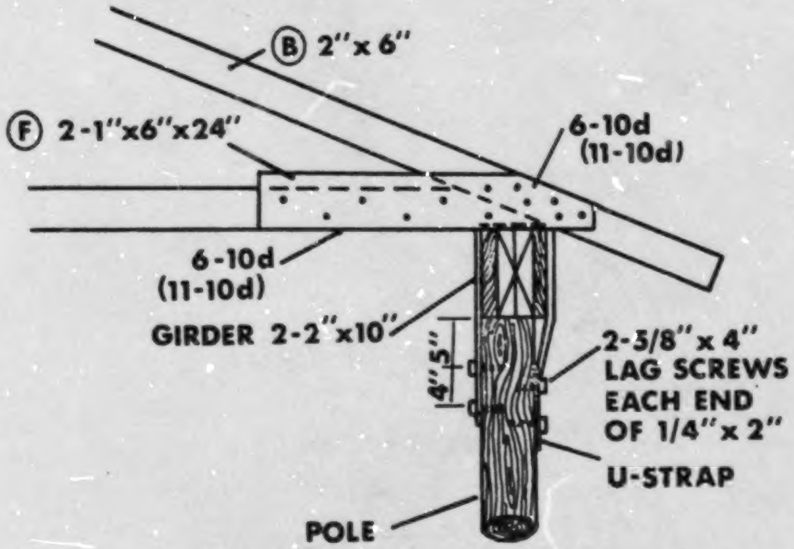

60'–0"
12'–0"
12'–0"
12'–0"
12'–0"
12'–0"
30'–0"
10'–0"
10'–0"
10'–0"

POLE BUILDING (plan)

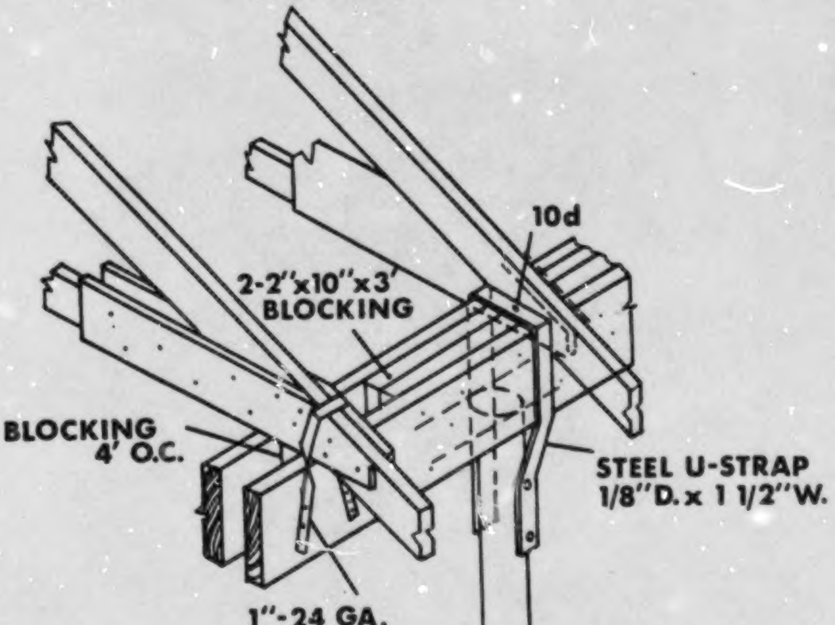

corrugated metal roofing
on 1"×4" strips
8'-6"
18'-0"
6'-7"
9'-6"
trusses 2'-0" o.c.
10'-0"
10'-0"
10'-0"
2"×6" girt
2"×4"×2' splice
metal siding
2"×6"
grade
11'-6"
4'-0"
8" min.
8"
16" diam. conc. footing

Cross Section
POLE BUILDING

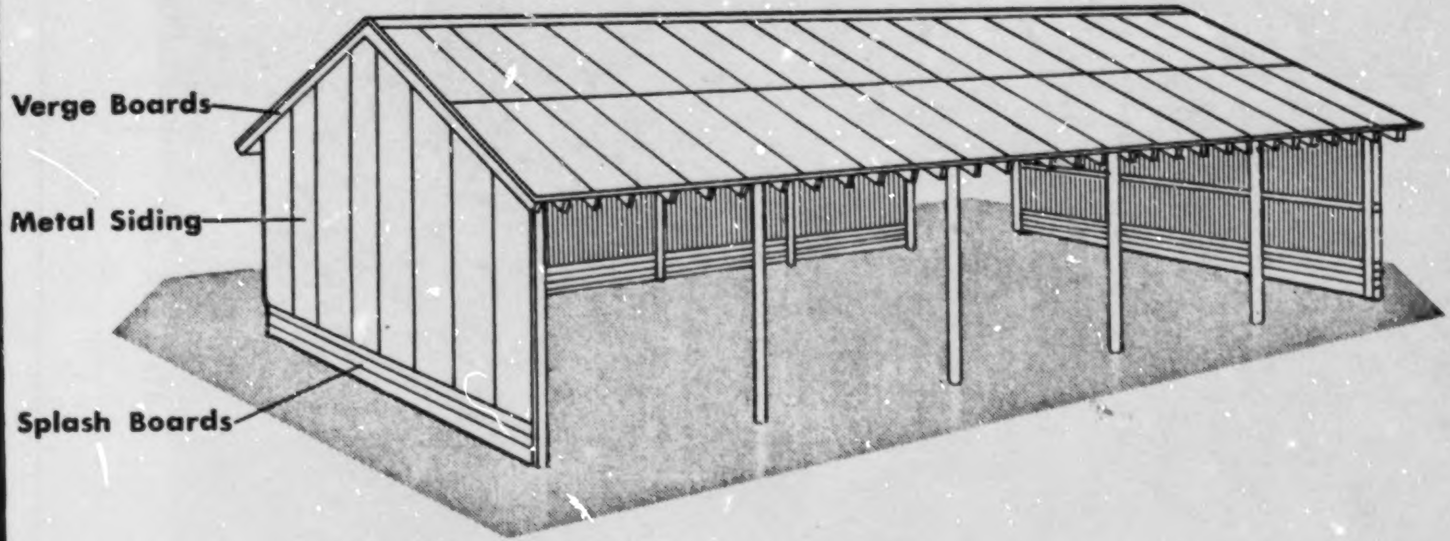
POLE BUILDING


Ⓑ 2"x 6"
Ⓕ 2-1"x6"x24"
6-10d
(11-10d)
6-10d
(11-10d)
GIRDER 2-2"x10"
4" 5"
2-3/8" x 4"
LAG SCREWS
EACH END
OF 1/4" x 2"
U-STRAP
POLE

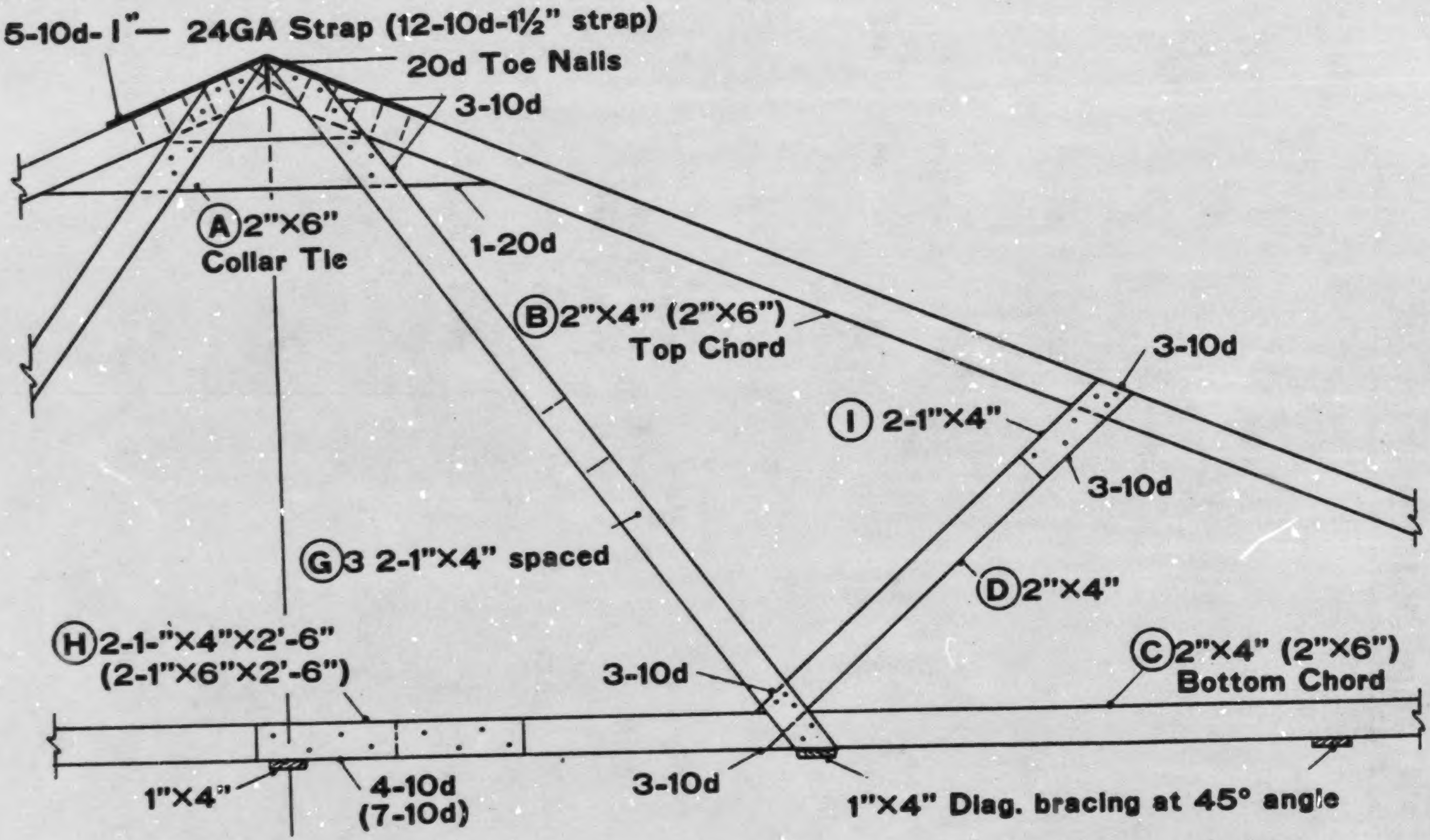
Detail


10d
2-2"x10"x3'
BLOCKING
BLOCKING
4' O.C.
STEEL U-STRAP
1/8"D. x 1 1/2"W.
1"-24 GA.
STEEL STRAP

Pole Building


Verge Boards
Metal Siding
Splash Boards

perspective view


5-10d- 1"— 24GA Strap (12-10d-1½" strap)
20d Toe Nails
3-10d
Ⓐ2"X6"
Collar Tie
1-20d
Ⓑ2"X4" (2"X6")
Top Chord
3-10d
Ⓘ 2-1"X4"
3-10d
Ⓖ3 2-1"X4" spaced
Ⓓ2"X4"
Ⓗ2-1-"X4"X2'-6"
(2-1"X6"X2'-6")
3-10d
Ⓒ2"X4" (2"X6")
Bottom Chord
1"X4"
4-10d
(7-10d)
3-10d
1"X4" Diag. bracing at 45° angle

Truss Detail

POLE BUILDING

695

696

Ag IV - XIII - 11

BILL OF MATERIALS

Ag IV - XIII - 12 **(pole building)**

TRUSSES (TOTAL 31)	SIZE	PCS.
(A) COLLAR TIE	2" X 6" X 14' - 0"	8
(B) TOP CHORD	2" X 4" X 18' - 0"	62
(C) BOTTOM CHORD	2" X 4" X 14' - 0"	31
BOTTOM CHORD	2" X 4" X 16' - 0"	31
(D) STRUT & (E) BLOCK	2" X 4" X 10' - 0"	31
(F) GUSSET	1" X 6" X 12' - 0"	31
(G) TIE & (H) SCAB	1" X 4" X 10' - 0"	124
(I) PAD	1" X 4" X 10' - 0"	16
DIAGONAL BRACING	1" X 4" 521 LIN. FT.	
POLES (PRESSURE TREAT)	16' - 0" LONG	16
NAILING GIRTS	2" X 4" X 16' - 0"	4
	2" X 6" X 12' - 0"	5
	2" X 6" X 10' - 0"	4
	2" X 10" X 10' - 0"	6
SPLASH BOARDS PRESSURE TREATED	2" X 6" X 12' - 0"	20
	2" X 6" X 10' - 0"	16
GIRDERS	2" X 10" X 12' - 0"	20
BLOCKING	2" X 4" X 16' - 0"	2
	2" X 4" X 10' - 0"	2
	2" X 10" X 12' - 0"	6
SPLICE	2" X 4" X 12' - 0"	2
VERGE BOARDS	1" X 6" X 18' - 0"	4

HARDWARE: 4 DOOR HANGERS, 48' OF SLIDING DOOR TRACK, NAILS, STRAPS AND PAINT

ROOFING: 23 SQUARES CORRUGATED METAL

WALLS & DOORS: 13 SQUARES CORRUGATED METAL OR 16 SOS SIDING

ROOFING: SPACED 1" X 4" STRIPS 2432'

Agriculture Building Construction

Unit II: Estimating the Amount of Concrete Needed (1 Hour)

1. Agricultural uses of Concrete.

   a. Fence posts
   b. Water troughs
   c. Walks
   d. Driveways
   e. Floors
   f. Feeding troughs
   g. Walls and foundations
   h. Milk houses
   i. Porches
   j. Septic tanks
   k. Cisterns
   l. Culverts
   m. Tile
   n. Building blocks
   o. Feeding floors
   p. Manure pits
   q. Silos
   r. Steps
   s. Tree surgery
   t. Small bridges
   u. Cattle guards
   v. Barbecue pits
   w. Setting posts
   x. Drainage tile

2. Advantages of Concrete.

   The advantages of concrete for agricultural construction are many and varied. Some of the most important reasons for its use are listed below:

   a. Fire proof
   b. Durable and permanent
   c. Watertight
   d. Economical
   e. Can be "homemade"
   f. Attractive
   g. Termite and rodent proof
   h. Storm resistant
   i. Low maintenance
   j. Sanitary
   k. Readily adapted
   l. Materials available locally

3. Ingredients Used in Concrete.

   Concrete is an artificial stone composed of:

   a. Cement - Portland cement is manufactured from lime, iron oxide, silica, and alumina. "Portland" is not a brand name, but one kind of cement. Portland cement is usually packaged in sacks containing 1 cubic foot which weights 94 pounds.

   b. Sand - (Fine Aggregate) particles range from very fine to 1/4 inch in diameter. Good sand has uniform mixture of various size particles.

   c. Gravel - (Coarse Aggregate) particles range from 1/4 inch to 1 1/2 inches in size. Good gravel has uniform mixture of various size particles.

   Aggregates (sand and gravel) are filler material to make the concrete mixture economical. The aggregates should be graded (uniform mixture of various size particles) so that smaller particles will fill spaces between larger particles. Aggregates should be free of dirt, silt, and organic matter.

d. Water - The water used in concrete should be of "drinking water quality" - clean and free of oil and other impurities. The amount used should be measured accurately.

4. Quality of Concrete.

The quality, durability, and strength of concrete depend upon:

a. Quality and amount of cement

b. Amount, kind and grade of aggregate

c. Amount of water used

d. Method of mixing, placing, and curing the mixture

5. Proportion of Materials in Concrete.

Transparency No. 1

a. The approximate volume of materials in concrete are:

Cement	10 percent
Water	15 percent
Sand and Gravel	75 percent

b. A "1:2:3 mixture" consists of one part (by volume) cement, 2 parts sand, and 3 parts gravel.

c. The strength of concrete is primarily determined by the amount of water added for each sack of cement used. (Water - Cement Ratio)

d. The proper amounts of water and cement should be used with aggregates being added until mixture is workable.

e. The amount of water in the sand should be considered and included when measuring the amount of water for the mixture. For example, a 5 gallon mix should contain only 5 gallons of water, including the water in the sand.

f. Determining Moisture in Sand

Transparency No. 1

To estimate the amount of moisture in sand, some sand is pressed into a ball in the hand.

Damp Sand - (1/4 gallon of water per cubic foot)
Falls apart when the hand is opened.

Wet Sand - (1/2 gallon water per cubic foot)
Ball of sand holds its shape when the hand is opened.

Very Wet Sand - (3/4 gallon of water per cubic foot)
Ball is formed and leaves hand wet when the hand is opened.

g. Consistency of Mixture

The proportions of the materials in the concrete mixture affect the consistency and workability of the mix. With the cement-water ratio a constant factor, the consistency is controlled by the addition of the aggregates.

Consistency of trial batches can be roughly measured by using the slump test. (This test utilizes a slump core and is detailed in Reference No. 1 if the teacher wishes to use local adaptation time to demonstrate the test.)

h. Recommended Mixtures

Transparency No. 2

5 Gallon Mix - For acid or alkaline resistant; walks, fence posts, flower boxes, thin work.

6 Gallon Mix - Water-tight; floors, tanks, walls; all reinforces concrete.

7 Gallon Mix - Foundation walls retaining walls; underground no water pressure.

6. Determining Amount of Materials Needed.

Transparency No. 2

a. When mixing cement, sand, and gravel, the smaller particles fill the spaces between the larger particles. Therefore, the volume of materials needed for a given volume of finished concrete must be calculated.

b. "Fuller's" rule states that the mixing of a total of 42 volumes of cement, sand, and gravel will produce 27 volumes of concrete.

c. The following problem illustrates the use of Fuller's rule.

Transparency No. 3

Using a 6 gallon mix (1 - 2 1/4 - 3), how many sacks of cement and cubic yards of sand and gravel will be needed to bulid a sidewalk 4 inches thick, 6 feet wide, and 100 feet long?

$$\frac{6' \times 100' \times 4''}{12} = 200 \text{ cubic feet of concrete}$$

$$\frac{200 \times 42}{27} = 311 \text{ cubic feet of raw materials}$$

1 + 2 1/4 + 3 + 6 1/4 volumes of mix

$$\frac{311}{6.25} = 49.9 \text{ or } 50 \text{ sacks of cement}$$

$$\frac{50 \times 2.25}{27 \text{ cu. ft./yd.}} = 5.6 \text{ cubic yards of gravel}$$

7. Mixing the Concrete.

   a. Machine Mixing

      (1) Determine mixer capacity and moisture content of the sand.

      (2) Put measured amount of water into mixer and start mixer.

      (3) Add part of gravel.

      (4) Add the measured amount of cement.

      (5) Add sand and gravel to obtain proper consistency.

      (6) Mix for 2 to 3 minutes.

   b. Hand Mixing

      (1) Place sand in mixing container.

      (2) Add cement and mix well with sand.

      (3) Add gravel and mix.

      (4) Add measured amount of water and mix well.

      (5) Add sand and/or gravel for proper consistency.

8. Ready-Mixed Concrete.

   a. Ready-mixed concrete may be purchased by the cubic yard in the mix that is desired.

b. The following procedure may be used to estimate the quantity of ready-mixed concrete needed. (Allows for 10 percent waste.)

(1) Determine surface area (Length x Width)

(2) To determine number of cubic yards:

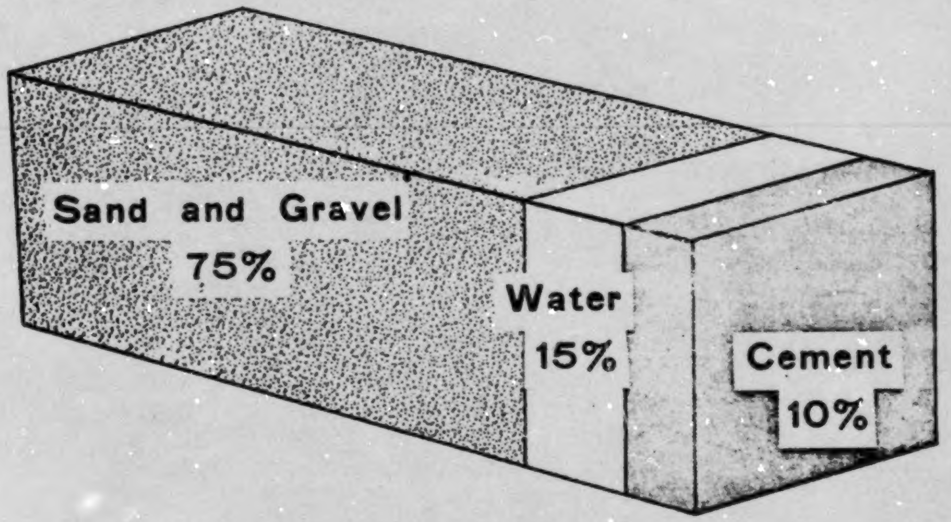
Divide area by:	For concrete thickness of:
300	1 inch
100	3 inches
75	4 inches
50	6 inches
25	12 inches

Example: A slab, 20' x 40', 4 inches thick is to be built. How much concrete should be ordered?

20' x 40' = 800 square feet (area)

$$\frac{800}{75} = 10.66 \text{ cubic yards}$$

VOLUME OF MATERIALS IN CONCRETE


Sand and Gravel
75%
Water
15%
Cement
10%

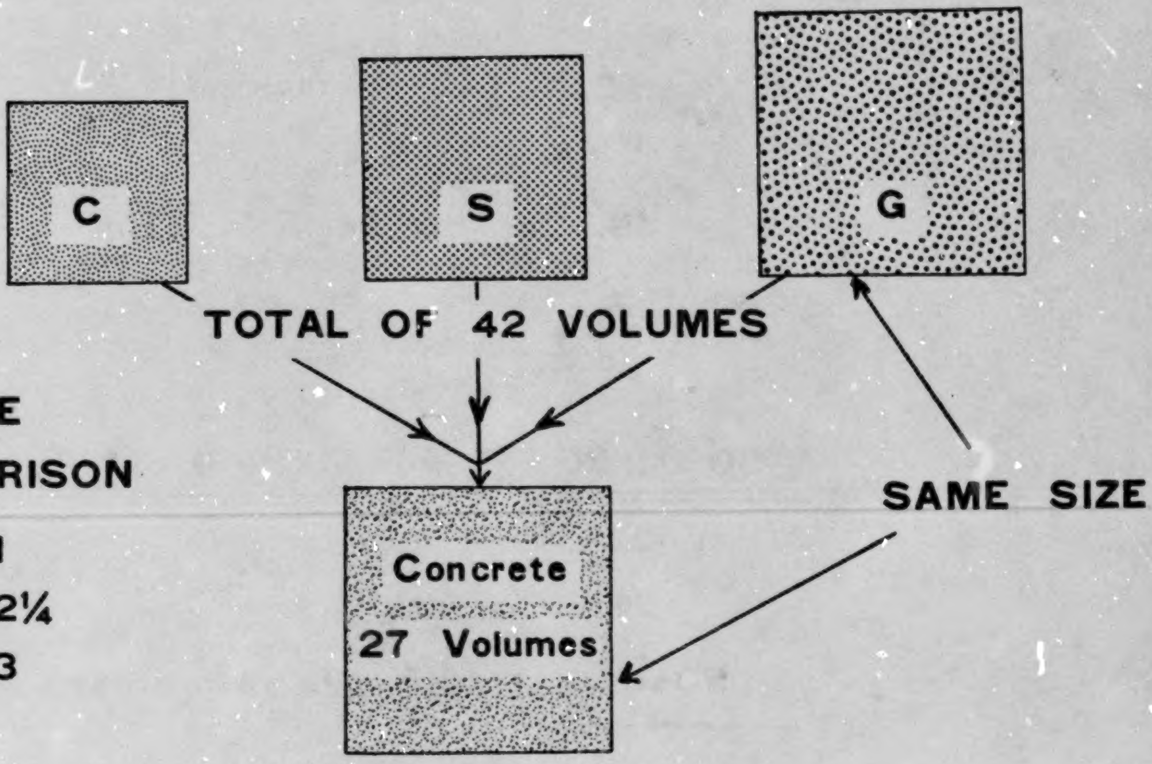
MOISTURE IN SAND

Damp Sand	Falls Apart	¼ gal. per cu. ft.
Wet Sand	Ball holds Shape	½ gal. per cu. ft.
Very Wet Sand	Sparkles, wets hand	¾ gal. per cu. ft.

RECOMMENDED MIXTURES

Mix	Water (Gal.) per Sack Cement			Trial Batch	
	Sand			Cu. ft. Sand	Cu. ft. Gravel
	Damp	Wet	Very Wet		
5 Gallon	4½	4	3¾	1¾	2
6 Gallon	5½	4½	4	2¼	3
7 Gallon	6¼	5½	4¾	2¾	4

FULLER'S RULE


C
S
G
TOTAL OF 42 VOLUMES
Concrete
27 Volumes
SAME SIZE

SIZE COMPARISON

C=1
S=2¼
G=3

PROBLEM

Use 1 - 2¼ - 3 mix to build sidewalk 4" thick, 6' wide, and 100' long.

$$\frac{6' \times 100' \times 4''}{12''} = 200 \text{ cu. ft. of concrete}$$

$$\frac{200 \times 42}{27} = 311 \text{ cu. ft. of raw materials}$$

$$1 + 2\frac{1}{4} + 3 = 6\frac{1}{4} \text{ volumes of mix}$$

$$\frac{311}{6.25} = 49.9 \text{ or } 50 \text{ sacks cement}$$

$$\frac{50 \times 2.25}{27 \text{ cu. ft. / yd.}} = 4.17 \text{ cu. yds. sand}$$

$$\frac{50 \times 3}{27 \text{ cu. ft. / yd.}} = 5.6 \text{ cu. yds. gravel}$$

Agriculture Building Construction

Unit III: Construction of Forms and Reinforcing (1 Hour)

1. Purpose of Forms.
   - a. Forms hold the concrete in the shape desired until it sets or hardens enough to stand by itself.
     - (1) Normally, the longer the forms stay on, the stronger the concrete.
     - (2) Forms should be kept in place at least 24 hours on all jobs.
   - b. Final shape and smoothness will be no better than the forms used.
2. Requirements of Good Forms.
   - a. Must be true to size and shape.
   - b. Should be rigidly braced to prevent bulging, sagging, and spreading.
   - c. Should be tight and free from openings to prevent leaking.
   - d. Should be easy to remove after concrete has set.
3. Constructing Forms.
   - a. To obtain a smooth finish, forms should be made of dressed, tongued and grooved lumber. Plywood and other manufactured products may be used to obtain a smooth finish.
   - b. Strips of sheet metal should be used to round off sharp corners and angles to make a stronger and neater job.
   - c. Crude oil or crankcase oil, painted on the inside of the forms, will keep the concrete from sticking to them when they are removed.
   - d Forms should have all pieces of concrete removed from them before using again.
4. Bracing Forms.

   Transparency No. 1

   - a. In addition to joining the forms with nails and wood bracing at strategic points, wire ties through the forms should be tightened against wood spacers.

b. The wood spacers should be removed as the placing of the concrete progresses.

c. Wires must be cut to remove the forms and they may be cut flush with the concrete after the forms are removed.

5. Removing Forms.

a. In warm weather, forms should remain in place two or three days.

b. In cold weather, allow twice as long.

c. In no case, should the forms be removed until the concrete has thoroughly set and there is no danger of damaging.

d. Forms left in place for at least a week aid the curing process by protecting the concrete from drying too rapidly.

e. The weather, temperature, and nature of the work determine the length of time to leave the forms in place.

6. Reinforcing Concrete.

Transparency No. 2

a. Concrete walls should be set on a footing to prevent uneven settling.

(1) Footing should be wider than the wall, usually twice as wide to distribute the weight over a wider area, and as high as the wall is wide.

Example: a 6 foot wall should have a footing at least 6 feet high and 12 inches wide.

(2) The depth is determined by the type of soil and climatic conditions. The footing should be below the frost line.

(3) Normally, the soil serves as the forms for footings.

b. Reinforcement is for the purpose of increasing the strength of concrete.

(1) Steel and wire mesh are usually used for reinforcement.

(2) For large jobs, engineers should be consulted for the proper type, size, and spacing of reinforcements.

c. Rules for Reinforcing Concrete.

(1) Use only clean steel (free from rust, paint, and scale).

(2) Place steel no closer than 3/4 inches from the outside surface.

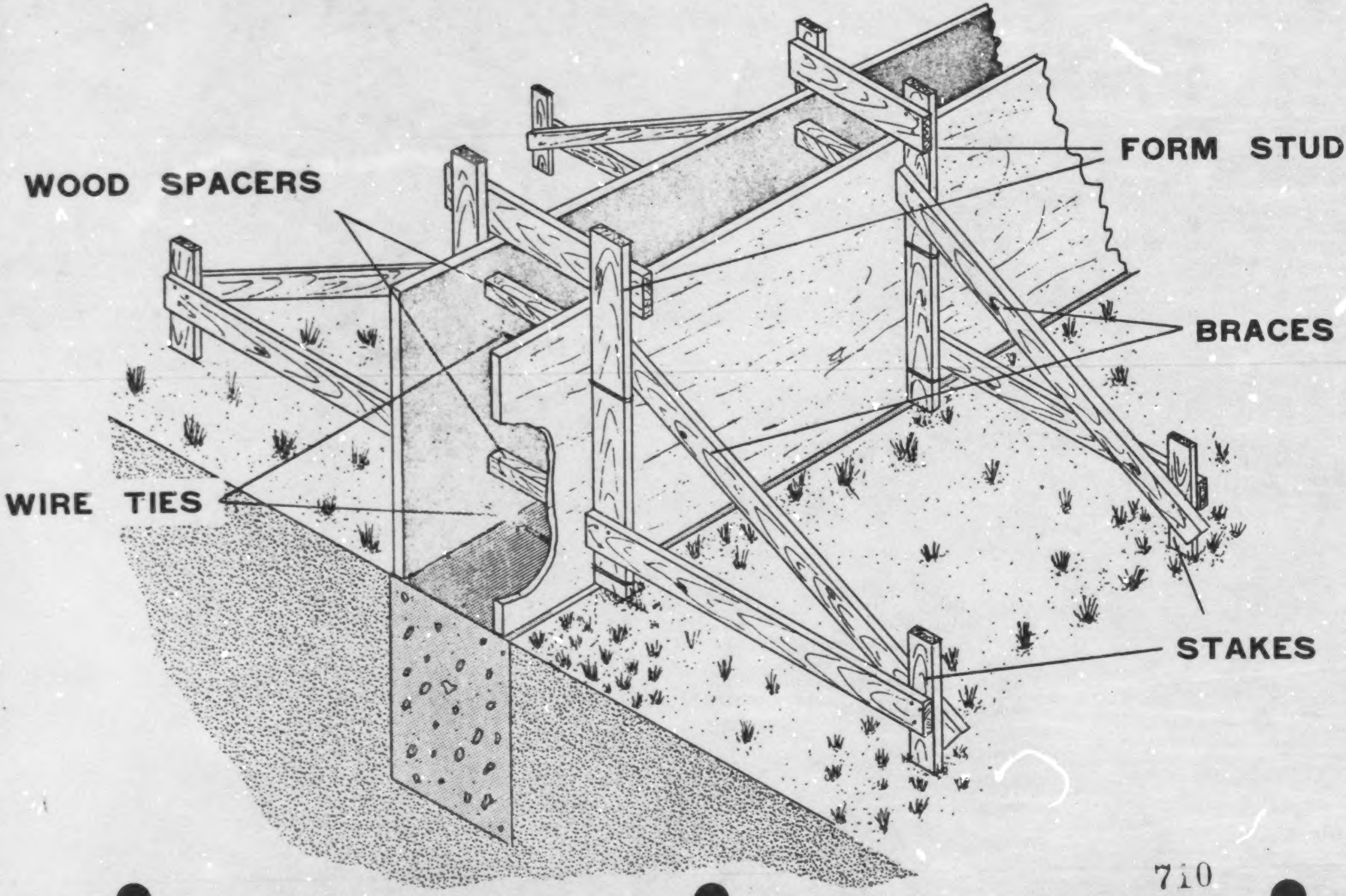
(3) Lap all bars 48 times their diameter (1/2 inch bars should be lapped 24 inches and then wired together).

(4) Place reinforcement where concrete will be in tension (such as corners, joints, etc.).

(5) Position wire mesh or steel near center of depth of slab or sidewalk.

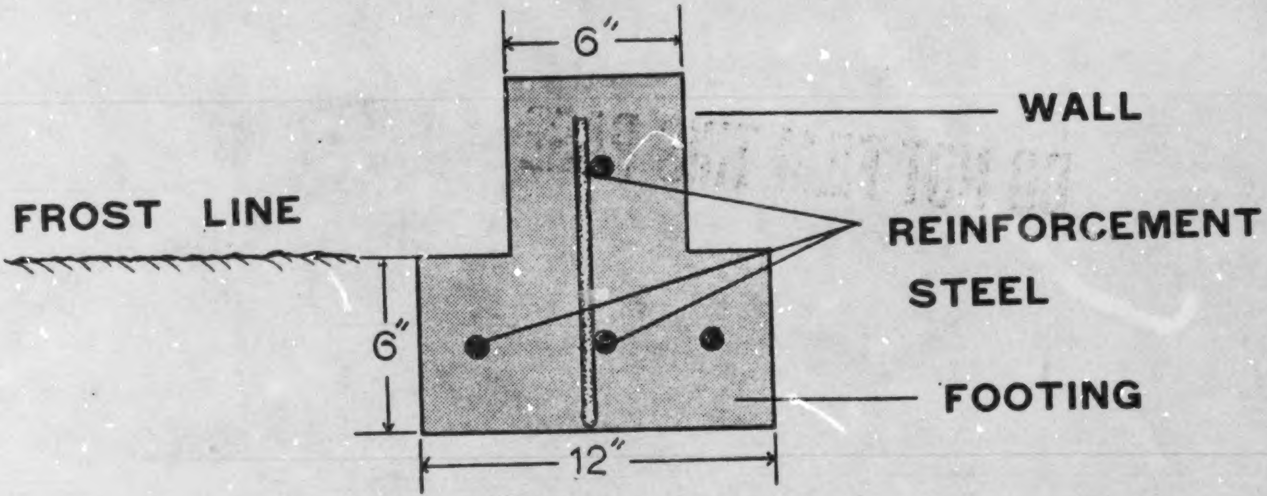
WOODEN CONCRETE FORM

Ag IV - XIII - 24

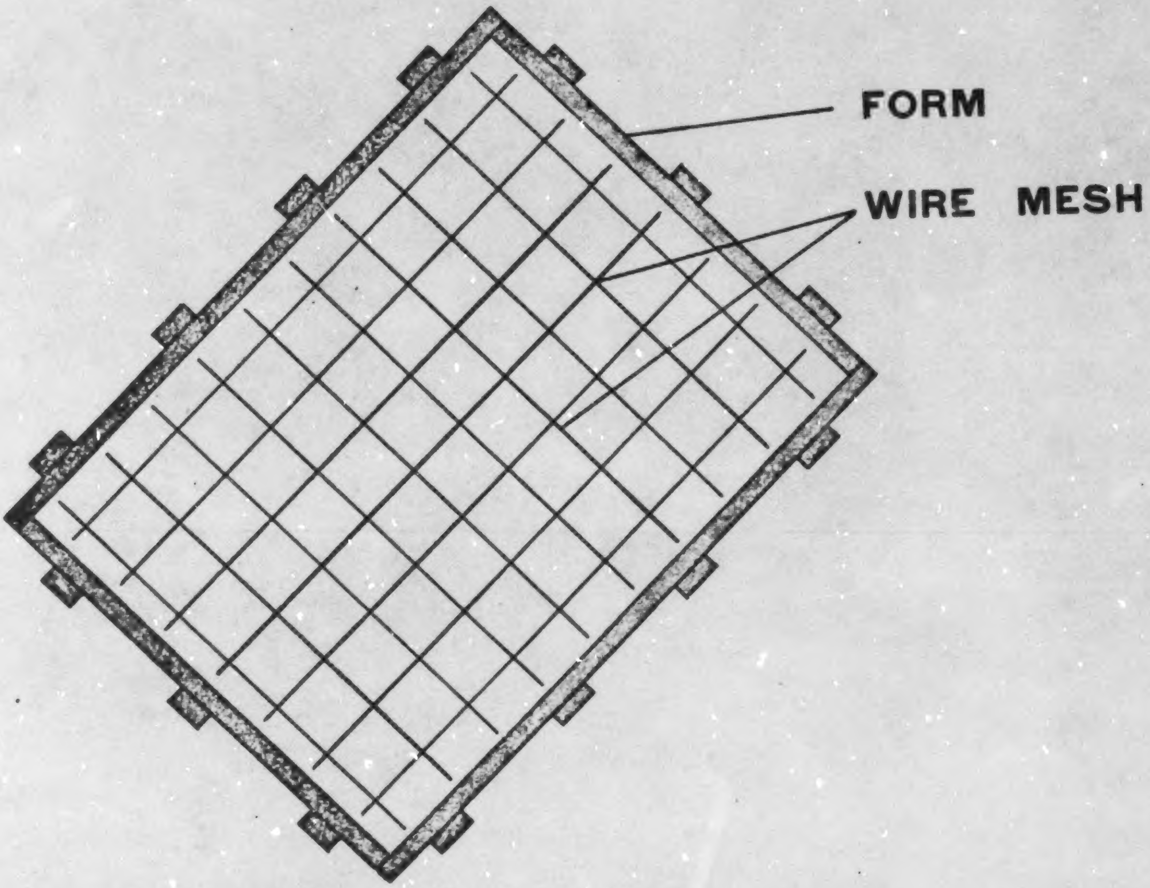

FORM STUDS
WOOD SPACERS
BRACES
WIRE TIES
STAKES

REINFORCEMENT

WALL AND FOOTING CROSS - SECTION


6"
WALL
FROST LINE
REINFORCEMENT STEEL
6"
FOOTING
12"

SLAB


FORM
WIRE MESH

Agriculture Building Construction

Unit IV: Placing, Finishing, and Curing Concrete (1 Hour)

1. Placing.

   a. Steps to take before placing concrete:

      (1) Forms should be sturdy and rigid.

      (2) If reinforcement is required, the proper type and size of reinforcement should be positioned properly and securely.

      (3) Forms should be oiled to prevent concrete from sticking to them.

      (4) The surface on which concrete is to be placed should be thoroughly wet down to keep it from absorbing moisture from the concrete.

      (5) Care should be taken to remove all debris, sawdust, nails, and other foreign matter from the forms.

      (6) Be sure the mix is of a stiff consistency to prevent segregation.

   b. Placing Procedures.

      (1) Place concrete in forms as soon as possible after mixing. It will begin to "set" within 30 to 45 minutes.

      (2) Place concrete where it is needed. Do not drag or allow it to flow. This will prevent honeycombing and segregation.

      (3) Place in even layers about 6 to 8 inches deep and tamp well.

      (4) In slab construction, start at the point farthest away from you, so the next batch will be placed against it to prevent segregation.

      (5) Avoid dumping concrete against the side of the forms.

      (6) Avoid letting the chute or buggy hit the side of the forms.

      (7) Tamp and spade the concrete mixture thoroughly to prevent air pockets.

(8) Work the mixture against the side of the forms so the large aggregates will be forced away from the forms for a smooth surface.

(9) When placing concrete on a slope, placing is begun at the bottom of the slope.

(10) In placing walls, the first batches should be placed at either end and worked toward the center.

(11) In all cases, procedures should be carried out to prevent water from collecting at the ends and corners of the forms. Water should not be allowed to form along the form faces.

2. Finishing Concrete.

Transparency No. 1

a. Concrete should be "struck off", screeded, or leveled as soon as it has been tamped or spaded in the forms. A 2 inch board on edge is moved at a slight angle across the concrete with a "back and forth" sawing motion. This pushes excess concrete ahead of the board and works the larger aggregates downward.

b. Finishing should be delayed until the surface is quite stiff but still workable.

c. Surface water should be allowed to evaporate.

d. Dry cement should not be sprinkled on top to remove moisture or for finishing purposes, as this material will form a layer that is likely to develop hair-line cracks.

Transparency No. 3

e. Edging and jointing usually follow the screeding operation. Edging should be done after the concrete has started to stiffen and after the water sheen has left the surface. Edging is done with an edger and results in a rounded edge to prevent chipping or damage to the edge of the concrete.

f. After the concrete is edged and jointed, it should be floated. Concrete exposed to wear from walking or machinery should be finished with a wooden float.

Floating is done to push the larger aggregates down away from the surface, to level the surface, and to bring mortar to the surface for other finishing operations.

g. A metal trowel brings a thick film of cement to the top, resulting in a smooth, slippery surface that does not wear so well.

The metal trowel should not be used until the water sheen has disappeared from the surface.

h. Types of Finish.

Transparency No. 2

TYPE	USE	OBTAINED BY
Gritty non-slipping	Walks, dairy barn floors, and similar	Using wood float
Coarse, scored surface	Driveways, feeding floors, lots, and ramps	Using a stiff broom (run broom across direction of trowel)
Smooth, troweled finish	Table tops, feed troughs	Using steel trowel
Pea grain	Porches and patios	Washing with water hose

3. Curing Concrete.

a. Curing simply means that plenty of moisture is present to obtain maximum hydration of the cement.

b. The chemical reaction, known as hydration, takes place between the cement and water. About 3 gallons of water are used for each sack of cement in the process of hydration.

c. Freshly mixed concrete contains much more than this amount of water, but unless the concrete is protected after placing, much water is lost from the mixture through evaporation and seepage. Precautions must be taken to prevent the water from evaporating too rapidly.

d. Curing should be started as early as possible and continued for at least seven days.

e. Moisture curing greatly increases the strength of the concrete.

f. Proper Curing Improves:

  (1) Strength

  (2) Durability

  (3) Watertightness

g. Common Methods of Curing:

  (1) Cover with straw, sand, wet burlap, or canvas as soon as possible without marring surface. Keep this covering constantly wet during the curing process.

  (2) Flood the surface and hold the water on the surface with some type of border around the edge of slab.

4. Trouble Shooting Concrete Failures.

SCALING
(When Surface Breaks Away From The Slab)

Causes	Preventative Measures
Early cycles of freezing and thawing of the surface of newly placed concrete.	Keep the temperature of freshly placed concrete about 50 degrees for at least 5 days.
Faulty workmanship. Any one of the finishing operations, screeding, troweling or floating, performed while free water is on the surface.	No finishing operation while free water is present should ever be done.

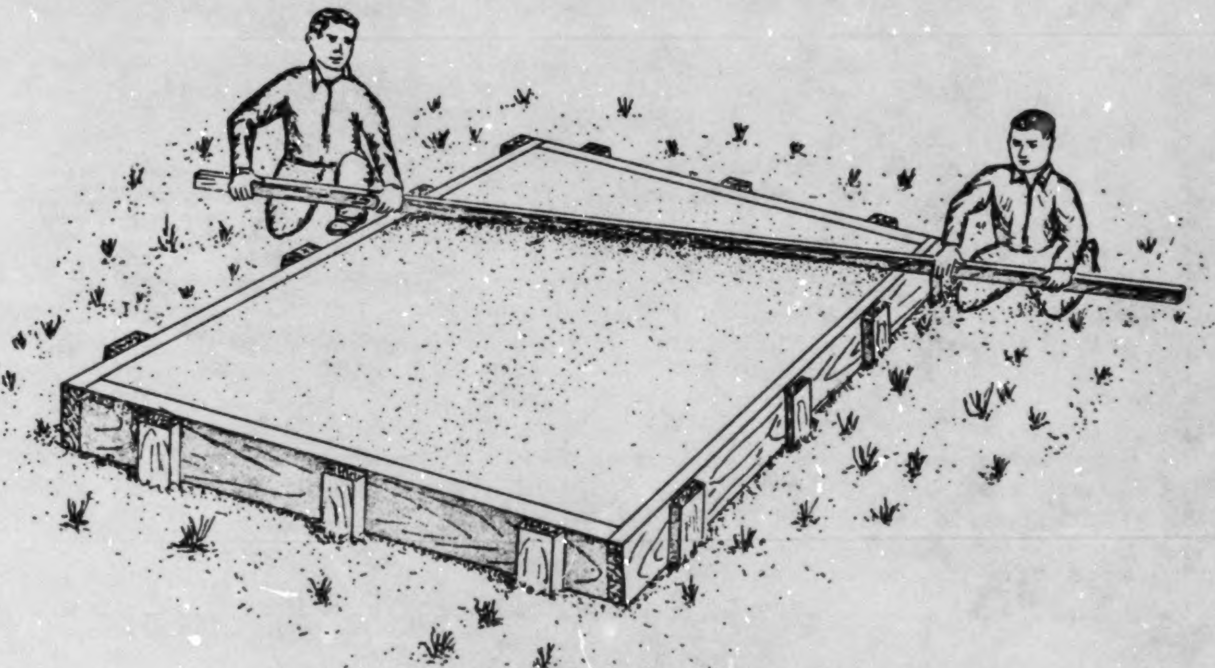
CRAZING
(Fine Hair Cracks on Surface)

Causes	Preventative Measures
Rapid surface drying usually caused by either hot sun, dry winds, or hot air temperatures.	Apply spray fog or cover with burlap immediately after striking off. Keep surface covered with burlap until ready for floating.
Premature floating and troweling. Working when there is excessive moisture.	Do not start floating and troweling until excess moisture has evaporated and concrete has started to "set."
Overuse of the jitterbug, vibrator, or bull float may contribute by working excess moisture to the surface.	Use these tools sparingly.

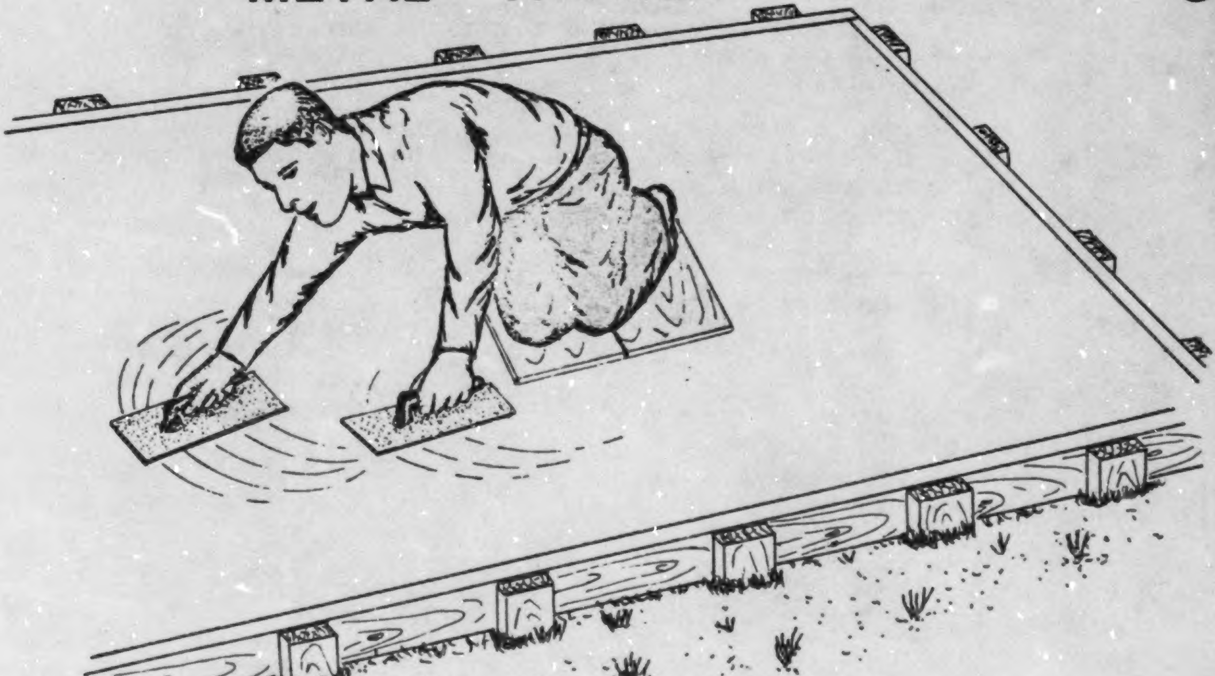
DUSTING
(Powdery Material On Surface)

Causes	Preventative Measures
An excess amount of clay or silt in the concrete. These mix with the sand and cement at the surface.	Use clean and well-graded fine and coarse aggregate.
Premature floating and troweling.	Delay until all free water has evaporated.
Carbon dioxide from gasoline engines. When this happens a reaction takes place that impairs proper hydration.	Provide adequate ventilation.
No curing or inadequate curing.	Proper curing for the specified length of time. Improperly cured concrete will wear easy by foot traffic.

SCREEDING



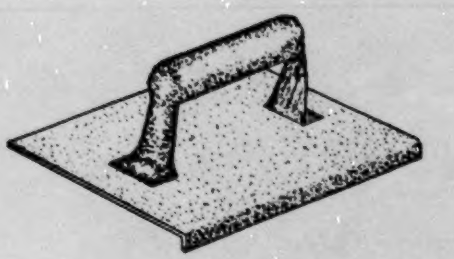
METAL TROWEL



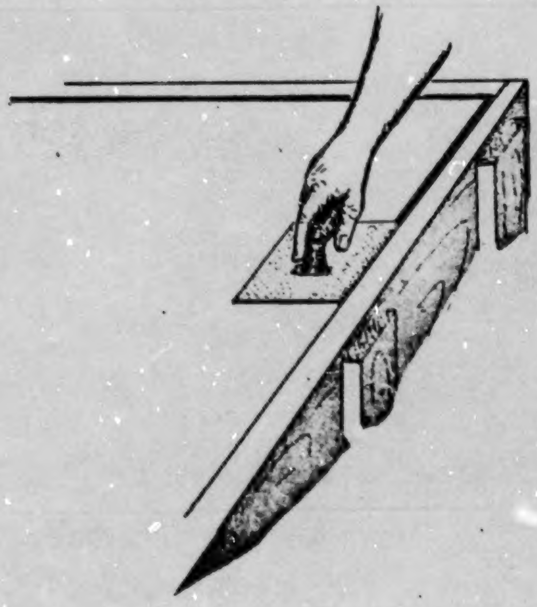
TYPES OF FINISH

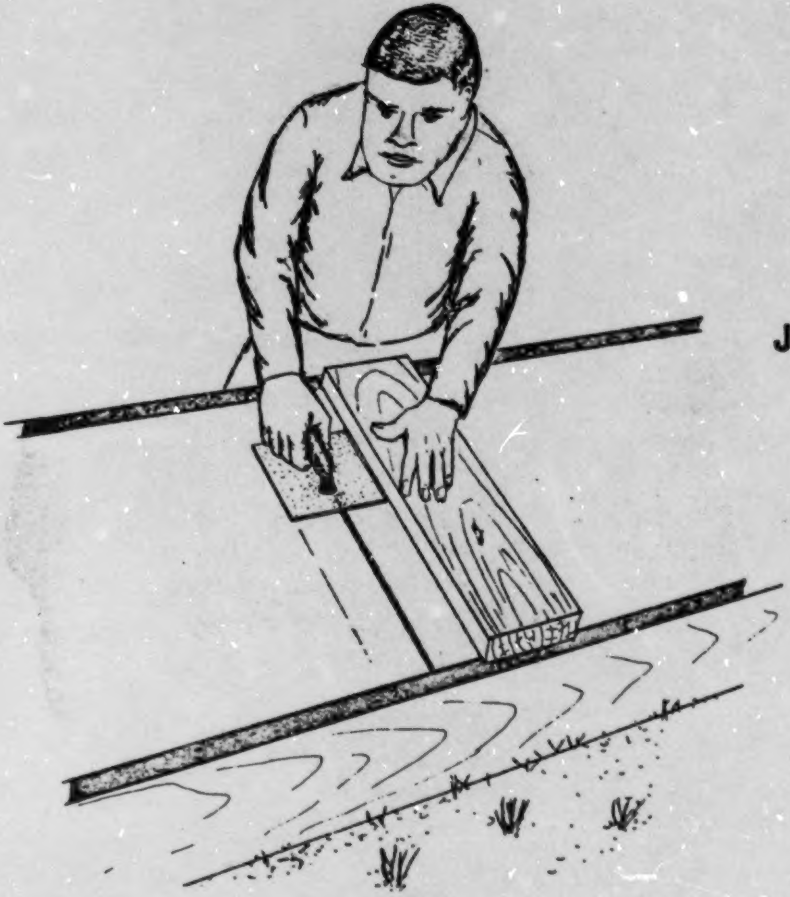
SURFACE	USE	OBTAINED BY
Gritty, non-slipping	Walks, dairy barn floors, etc.	Using wood float
Coarse, scored	Driveways, feeding floors, ramps	Using stiff broom
Smooth finish	Table tops, feed troughs	Using steel trowel
Pea grain	Porches, walks, patios	Washing with water hose

EDGING AND JOINTING

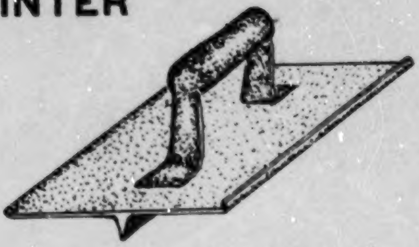


EDGER





JOINTER



Agriculture Building Construction

Unit V: Concrete Masonry (3 hours)

Suggested Procedure and Activities: A display of typical concrete masonry units may be helpful during the class discussion.

1. The Importance of Concrete Masonry.

   a. Many farm structures are built of concrete masonry materials for the following reasons:

      Masonry structures are usually very durable. They resist severe weather conditions in most areas.

      Less maintenance is required during the life of the building than is required for wood and some metal structures.

      The masonry material does not corrode. This makes it adaptable to wet areas and areas that contain minerals in the air and soil that may affect metal. It is not affected by animal waste.

      Masonry materials are firesafe, whereas most wood materials are not fire proof.

      Most masonry structures are rodent and termite proof, that is, if the structure is constructed to eliminate damages by these pests.

      Masonry buildings may be more economical to construct than steel or wood buildings.

   b. Usually the term "concrete masonry" refers to concrete blocks or units made of a mixture of Portland cement, sand, pebbles, cinders, or crushed rock, and water. However, buildings made of structural clay tile, brick, and stone are also considered as masonry structures.

2. Concrete Masonry Units or Blocks.

   Transparencies Nos. 1 and 2

   Many different sizes and shapes of concrete masonry units are used in constructing buildings. The types and sizes of blocks are:

   a. Stretcher (3 core) - 8 x 8 x 16 inches.

   b. Stretcher (2 core) - 8 x 8 x 16 inches.

   c. Corner - 8 x 8 x 16 inches.

d. Jamb or Joist - 8 x 8 x 16 inches.

e. Bull Nose Corner - 8 x 8 x 16 inches.

f. Pier or Double Corner - 8 x 8 x 16 inches.

g. Header - 8 x 8 x 16 inches.

h. Partition - 4 x 8 x 16 inches.

i. Beam or Lintel - 8 x 8 x 16 inches.

j. Solid Top - 8 x 8 x 16 inches.

k. Solid - 4 x 8 x 16 inches.

l. Sash - 8 x 8 x 16 inches.

The actual measurement of an 8 x 8 x 16 inch block is 7 5/8 x 7 5/8 x 15 5/8 inches. If the block is laid with a 3/8 inch mortar joint, the height area will be 8 inches and the length area 16 inches. All blocks of the same type are not the same size. For example, stretcher blocks may be 10 or 12 x 8 x 16 inches. It is usually a general practice to plan masonry buildings so that dimensions may be divided by 8 inches.

3. Foundations and Footings.

A good foundation is an important part of any good building. The foundation cost is a fractional part of the cost of the entire building. The foundation consists of the bed (earth giving support), footing (the wide part of the foundation on the bed), and the wall (part of foundation resting on the footing).

The purpose of the foundation is to distribute the weight of a building and its contents over a given area so that the soil can support the entire weight of the structure.

The size of a footing depends upon the type of soil and the weight of the structure and its contents. For example, soft clay has 1/4 the load carrying capacity of loose gravel or coarse sand. Some footing sizes are:

8 inch thick wall - 8 x 16 inch footing
10 inch thick wall - 10 x 20 inch footing
12 inch thick wall - 12 x 24 inch footing

Normally the footing is twice as wide as the foundation wall and as thick as the wall is wide.

Foundation walls may be constructed of cast-in-place concrete or concrete masonry. The cast-in-place walls may be poured at the same time the footing is poured or they may be poured separately. Concrete masonry walls are constructed by placing a bed of mortar on the footing to provide a good joint between the footing and block.

Most continuous foundations are set in the ground to prevent certain rodents from burrowing below them and to prevent rain from washing soil from beneath the foundation. Foundation walls may be capped if made of block to act as a termite barrier. The block cores are also filled with concrete to support beams.

4. Masonry Walls.

Transparencies Nos. 3a, 3b, 4a and 4b

a. Masonry walls should be constructed on dimensions that are divisible by 8 inches. Actually, this measurement must start with the foundation. If the masonry material is to be cut, a waste of materials and a waste of time will be involved in construction. Cut blocks distract from the appearance of a structure.

The wall should be constructed with full and half blocks. If the walls are built with 8 and 10 inch blocks it should not exceed 35 feet in height. Below grade walls are much stronger if built with 12 inch blocks.

b. Pilasters are columns that project about one third of their width to give the wall added support. If a building is longer than 2 1/2 times its width and does not have partitions that abut it, pilasters should be spaced as follows:

12 feet from center to center for an 8 inch block wall.
15 feet from center to center for a 10 inch block wall
18 feet from center to center for a 12 inch block wall.

c. Lintels are reinforced beams used over openings (doors and windows). The lintel should be long enough to extend 8 inches on each side of the opening. The number and size of reinforcing bars used in lintels depends upon the number of feet clear span or the width of the opening below the lintel. For example, an opening up to 8 feet in width requires a lintel 7 5/8 inches high, 7 5/8 inches wide, and reinforced with two No. 3,3/8 inch round bars.

Steel lintels are used on several types of masonry walls. Reinforced tile is also used. Steel lintels are found on most brick walls, and tile lintels are used on tile walls.

d. Anchor bolts are used to anchor roofs to the walls. Bolts 1/2 inch in diameter by 18 inches long are inserted in block cores on four foot centers to anchor roofs. The bolts are fastened in the blocks by filling the cores with concrete. An 18 inch bolt will extend into the second layer of block. Wood plates are tied to tile walls by these anchor bolts.

Brick, rock, and tile veneer walls are tied to frame walls with metal ties; therefore, the roof is anchored to the wood frame.

e. Flashing prevents moisture from entering the masonry wall. It may be placed at the head or top of openings, top of foundation, and on window sills. It is necessary to use flashing on brick and tile walls where the masonry units are laid in a different direction. Usually, the bricks that form the sill on a window are laid so that the ends of the bricks show.

The most common metals used for flashing are:

Galvanized Sheet Metal - 26 gauge,

Hard Copper - 16 ounce, and

Aluminum.

f. Partitions may be constructed of the same material as the wall if the partition helps support joists or other loads. Non-supporting partitions may be constructed of masonry materials three to six inches in width. There are special blocks and tile for partitions.

Some masonry walls are bonded with the partition by the use of steel tie-rods, spaced about three feet apart. Partitions that do not support joists may be tied to walls by heavy wire mesh. The mesh strip should be placed in every other joint at the time the wall is constructed.

5. The Preparation and Use of Mortar.

a. The purpose of mortar is to bond masonry units together to form strong walls and partitions. It is necessary that mortar have the strength to carry wall loads for the life of the structure. The solids in a mortar mixture are Portland cement, hydrated lime, and sand. The strength of a mortar bond is affected by the following factors:

The quantity and type of cementing material.

The plasticity of the mortar and its workability.

The water holding capacity of the mortar.

The surface texture of the bedding area where the mortar is used.

The rate of suction of the masonry blocks or units.

The quality of workmanship when using mortar.

b. Mortar should be mixed for most jobs in a power mixer. It should be used within 2 1/2 hours after mixing. If evaporation causes the mortar to stiffen on the mortar board, it may be retempered by adding a small amount of water and remixing.

A ready mix of cement and hydrated lime is widely used because it eliminates the need for stockpiling extra material. Mortar sand and water are the other two ingredients needed for a complete mortar mix when masonry cement is used.

The proportions of materials by volume for mortar mixes are:

Cement	Hydrated Lime	Damp Mortar Sand
1 Portland Cement	1 to 1 1/4	4 to 6
1 Masonry Cement	----	2 1/4 to 3
1 Masonry Cement plus 1 Portland Cement (heavy load construction)	----	4 1/2 to 6

Water is added until the mixture becomes plastic and works well with the trowel.

About 100 blocks 8 x 8 x 16 inches may be laid with one sack of masonry cement and three parts of sand. If the exposed area of a block is 7 5/8 by 15 5/8 inches and the mortar joint is 3/8 inch, the quantity of block and mortar to use for 100 square feet of wall area is:

Thickness of Wall (Inches)	Number of Blocks	Cu. Ft. of Mortar
8	112	8.5
12	112	8.5

Transparencies Nos. 5, 6, 7, 8, and 9

6. Laying Concrete Blocks.

   a. Place concrete blocks on a platform or pallets to protect them from ground moisture. Cover blocks to protect them from rain. Blocks must remain dry before and after laying.

   b. Locate the corners and string out the first layer of blocks to check the layout. The blocks may be aligned by using a chalked snap-line.

   c. Remove the line of blocks and place a full mortar bed on the foundation wall. Position the corner block first. Apply mortar to the vertical joints before setting them in place. Apply mortar to the thicker surface of the block.

   d. After the first few blocks are laid, check the alignment and grade by using a mason's level as a straight edge and level. Use the trowel to tap the blocks in place. Lay the first course with care. If the first course is leveled and plumbed, succeeding courses will be easier to lay.

   e. After the first course is laid, apply mortar on each side of the (upper surface) laid block. Then apply mortar to the vertical edges of the block to be laid. Mortar may also be applied to the vertical face of the laid block.

   f. Lay the corners first, making them four or five courses higher than the center of the wall. Check with a mason's level for alignment, for being plumb, and for being level. The height of a course should be checked with a course pole which is graduated in 8 inch markings. The blocks may be checked for alignment by placing the level at a diagonal position from the corner.

   g. Lay blocks between corners by first stretching a line so that the top of the course to be laid will touch the line. Blocks are leveled and aligned by tapping them with the trowel handle as they are set in place. The face of blocks can be checked with the level. Remove excess mortar and rework it on the mortar board before using the second time.

   h. Close the course by buttering all four vertical edges of the blocks and lower the closure block into place. If an open space appears, remove the block and repeat the procedure.

   i. Tool the mortar joints as soon as the mortar becomes thumb-print hard. Tooling forces the mortar against the block edges and produces uniform clean lines. The tooling tool should be about 24 inches long, turned up at one end, and should have a handle in the center. A 5/8 inch round bar will produce a concave joint, and a 1/2 inch square bar will produce a V-shaped joint. The wall should be rubbed with a burlap bag to remove mortar burrs.

j. Wall control joints may be made after the mortar is quite stiff or during the time the wall is being constructed. The methods of forming a control joint are:

Remove the mortar from a depth of about 3/4 inch and force calking compound into the vertical joint. Use control joint blocks that are made full and half length at the time the course is being laid. Jamb block may be used as wall control block if the joint is reinforced by a Z-tiebar.

k. Intersecting bearing walls terminate at the face of the main wall with a control joint at that point. Use tie bars (metal lath 1/4 inch thick, 1 1/2 inch wide and 28 inches long, with 2 inch right angle ends). The ends of the lath are imbedded in concrete on the horizontal joints.

l. Tie nonbearing wall to main wall by using 1/4 inch mesh galvanized hardware cloth in the horizontal joints of both walls. The hardware cloth is usually tied into the main wall first. Where the two walls meet, the mortar is chipped out 3/4 of an inch and the vertical joints are filled with calking.

7. Laying A Cavity Wall.

Transparency No. 9

a. Cavity walls are actually two walls that are constructed on a single foundation. Such walls may be constructed of partition masonry units that are 3 5/8 x 7 5/8 x 15 5/8 inches in size. The following procedure is used to construct the walls.

b. The masonry units are laid in the same manner as laying standard wall blocks. An air space is left between the walls, and they are tied together across the air space by a No. 6 gauge wire. The wire is bent in the form of a rectangle, and it is spaced every 16 inches vertically and 32 inches horizontally.

c. Weepholes may be made at the bottom of the walls by placing a piece of rubber hose in the horizontal joint and removing it after the mortar has hardened. Approved metal flashing is placed on the first course masonry unit and on the foundation wall (metal flashing bent in the form of a slanting double L -_/‾) to free the cavity of moisture.

d. The cavity is protected from mortar droppings while constructing the walls by placing a board across the opening. The board is pulled from between the walls and cleaned.

e. Four-inch clay tile is commonly used to construct cavity walls. Tile is lighter and easier handled than concrete blocks for this type of work. Block walls may cost less to construct than tile walls.

8. Veneered Walls.

Transparency No. 10

a. One of the most common types of masonry wall for homes is brick veneer. There are also homes that have rock veneered walls. These walls are supported by a masonry foundation and a frame wall. The frame wall is usually made of wood studs, pressed board, or wood outside sheathing covered with building paper and an interior wall covering.

b. The brick or stone is tied to the wall by metal ties that are nailed to the wall and extended into the mortar on the upper horizontal side of the brick or stone. These ties should be spaced not more than 2 feet apart, and there should be a tie for each two square feet of wall.

9. Laying Brick, Tile, and Stone

The general procedure used to lay concrete block is used to lay brick, stone, and tile. But certain practices are followed when laying brick and other masonry units that are not followed when laying concrete blocks.

a. Laying brick - Brick should be soaked with water several hours before they are laid. The outside should be dry and the inside moist at the time they are laid.

A thick mortar bed is spread before mortar is placed on the end of the brick.

As the brick is pushed into place, excess mortar is squeezed from the joints and cut off. Mortar joints range from 1/4 to 1/2 inch thick.

The joints are tooled to force the mortar against the brick and make the joints appear smooth. Proper tooled joints are more weather resistant than rough joints.

Transparency No. 10

The four most common types of brick are:

Standard - 2 2/3 x 4 x 8 inches
Norman - 2 2/3 x 4 x 8 inches
Roman - 2 x 4 x 8 inches
SCR - 2 2/3 x 6 x 8 inches

Brick classes are: building, facing, and glazed facing.

b. Laying Stone - Stone should be soaked and the outer surface allowed to dry before it is laid.

A full mortar bed is necessary for laying stone properly. About 3/4 of an inch of mortar is removed before the mortar hardens. The raked out joints are moistened and refilled (flush or concave) with mortar.

Rubble stone masonry (from roughly dressed or field stones) is considered most appropriate for farm buildings. Ashlar stone masonry (from sawed or dressed stones) is not commonly used for farm structures.

c. Laying Tile - The first course of tile is laid in a full bed of mortar in the same manner as concrete block. Facing tile stretcher units usually are available either with vertical or horizontal cells.

The horizontal-cell that is more than four inches wide is laid in a divided mortar bed (two rows of mortar along the inner and outer edges). One end of the tile is buttered with mortar before it is placed in the bed.

The tile mortar joint should be about 1/2 inch thick. The joint should be tooled with a round bar.

Three types of tile are structional facing, back-up, and grain bin or silo. Structional facing tile may be glazed or unglazed and used for interior or exterior walls. Back-up tile is used as a support or backup wall for brick or tile. It may also be used as a base for planters. Grain bin or silo tile is used for the construction of circular bins.

Transparencies Nos. 11 and 12

10. General information on Concrete Masonry.

a. Concrete block may be used as backup for brick, stone, and tile. The first course may be a header or stretcher course. The ends of the brick will show in a header course, whereas the sides will show in a stretcher course. One stretcher course on the inside of the bricks should be parged (mortar spread over sides of bricks) before the block is fitted into place.

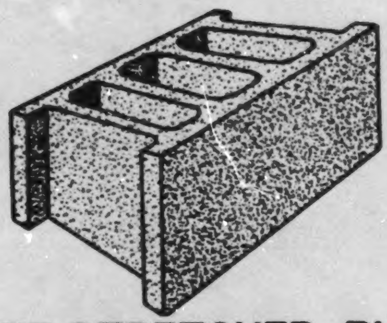
b. Cutting concrete masonry units may be done with a chisel and mason hammer or a masonry saw. If a chisel is used, the block should be scored on both sides before the cut is made. If a saw is used, the masonry unit should be dry.

c. Any masonry structure should be protected from rain; therefore, tarpaulins or plastic covers should be used for covering structures with moist or soft mortar.

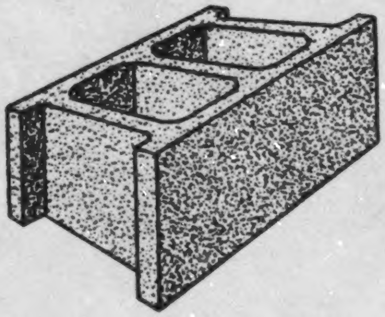
d. Cleaning and patching masonry structures is a final step to completing the job. The steps that may be followed are:

Fill all nail or line pin holes with fresh mortar. Avoid smearing fresh mortar in masonry units. Mortar droppings that stick to the units (blocks, bricks, and tile) should be allowed to dry before removing. A trowel and a brush are good hand tools to aid in removing mortar patches.

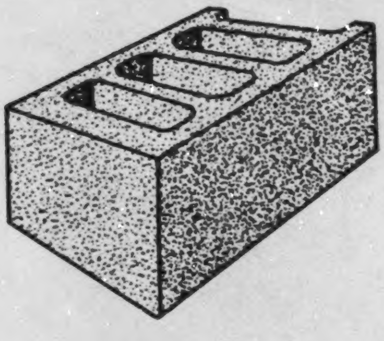
MASONRY BLOCKS



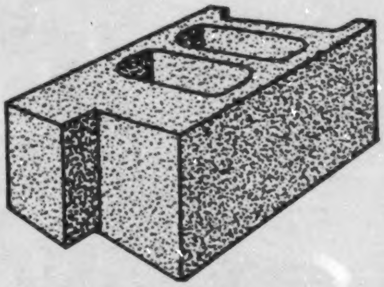
3—CORE STRETCHER BLOCK



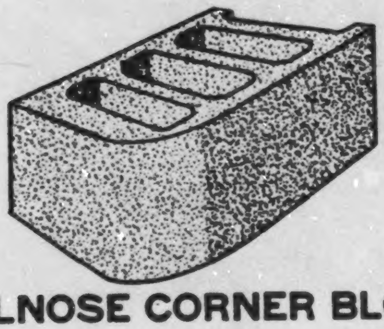
2—CORE STRETCHER BLOCK



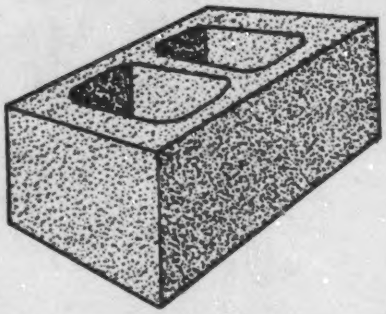
CORNER BLOCK



JOIST OR JAMB BLOCK



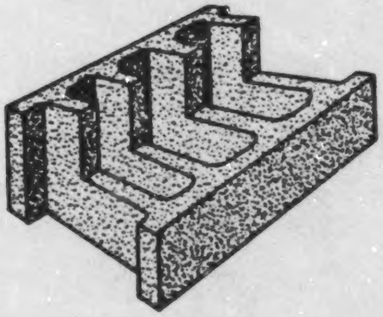
BULLNOSE CORNER BLOCK



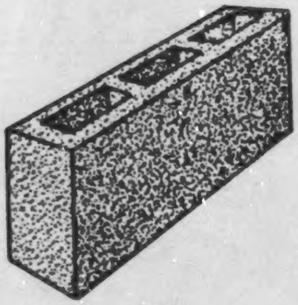
DOUBLE CORNER BLOCK

Ag IV - XIII - 46

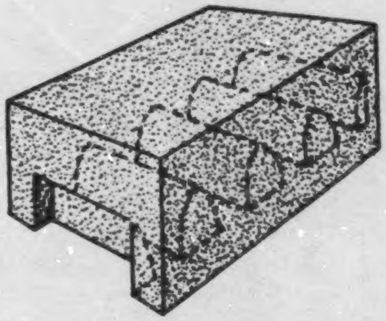
MASONRY BLOCKS



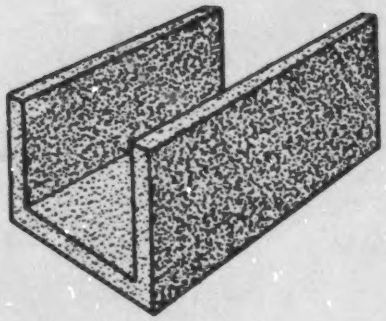
HEADER BLOCK



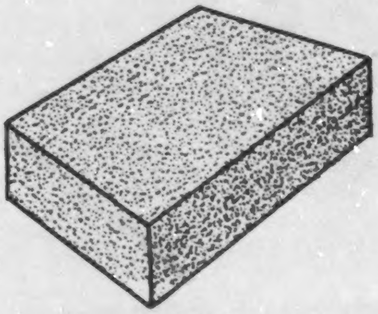
PARTITION BLOCK



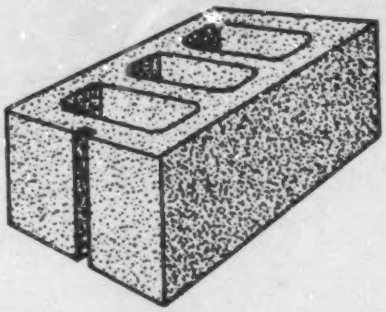
SOLID TOP BLOCK



BEAM OR
LINTEL BLOCK



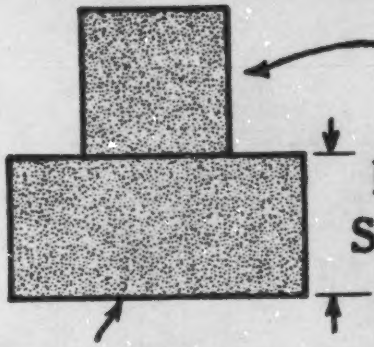
SOLID BLOCK

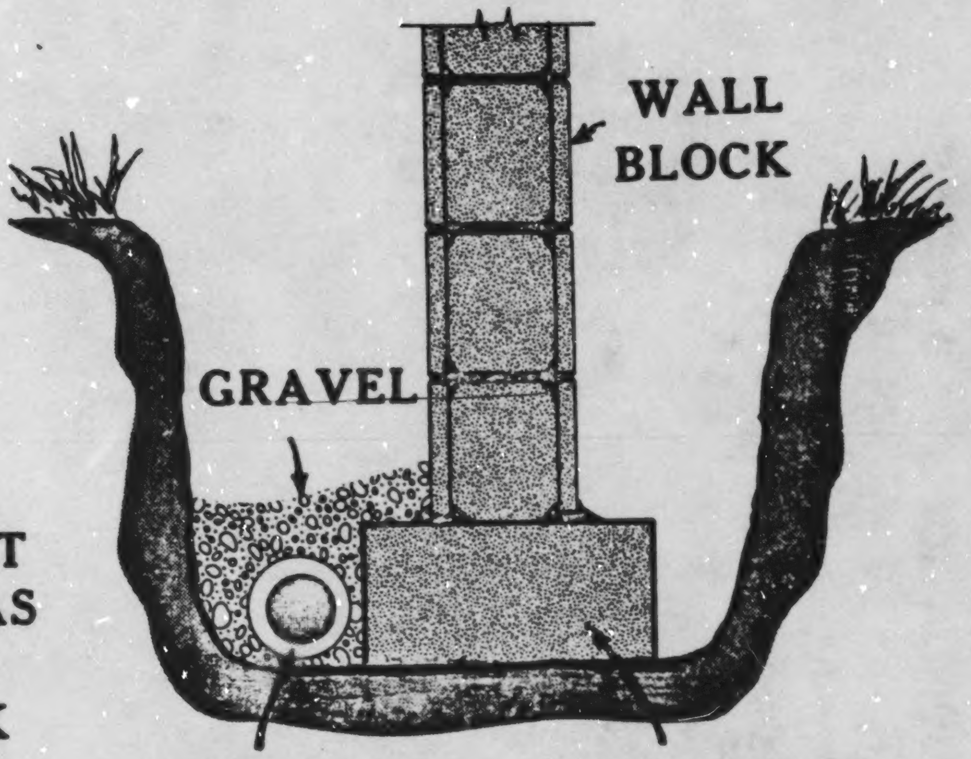


SASH BLOCK

FOUNDATIONS AND WALLS

CONCRETE WALL


HEIGHT
SAME AS
WALL
BLOCK
FOOTING
TWICE WIDTH
OF WALL


WALL
BLOCK
GRAVEL
DRAIN TILE
FOOTING

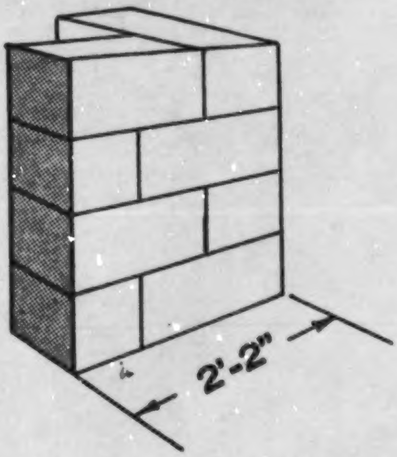
TWO TYPES OF FOUNDATIONS

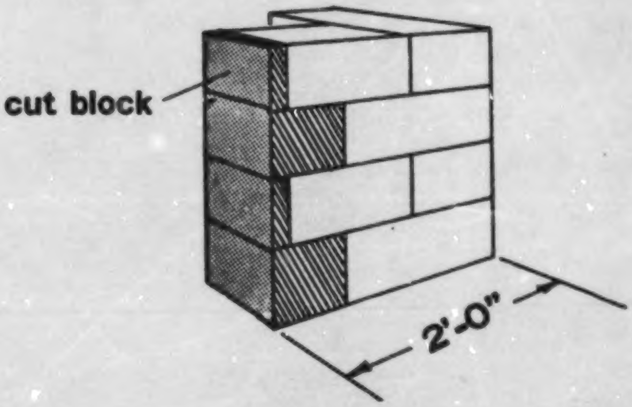
732

733

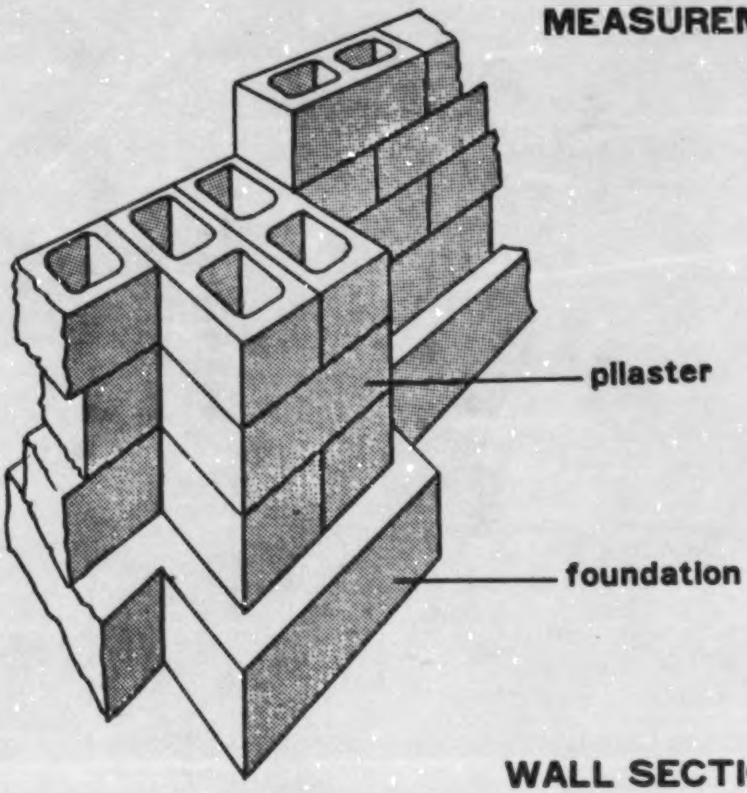
FOUNDATIONS AND WALLS

CORRECT WALL MEASUREMENT



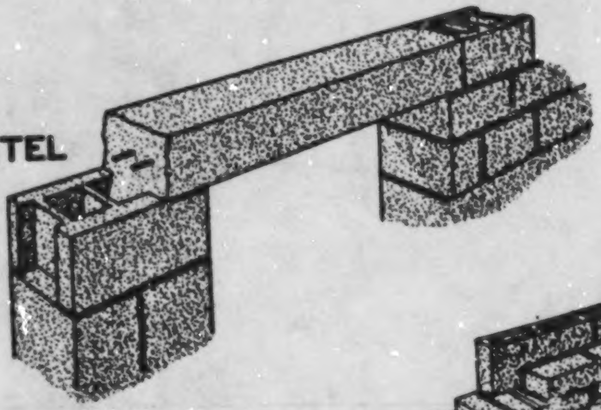

cut block
2'-0"

INCORRECT WALL MEASUREMENT

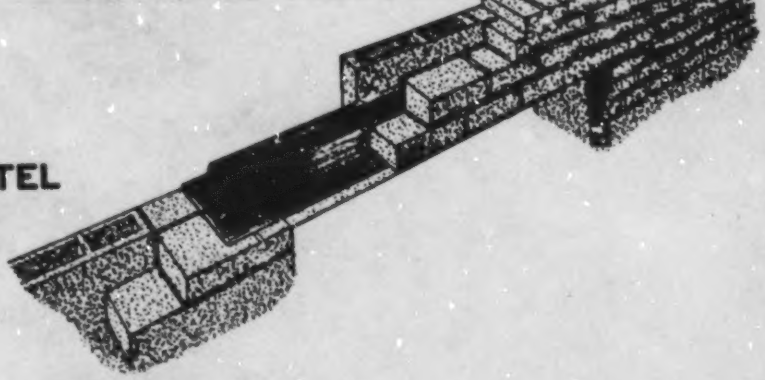

pilaster
foundation

WALL SECTION

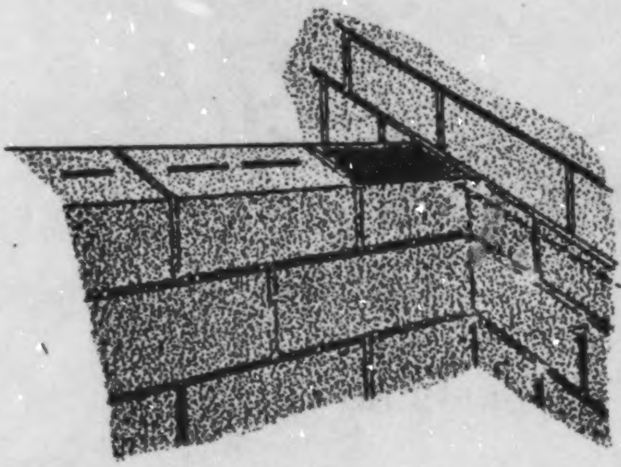
MASONRY WALLS



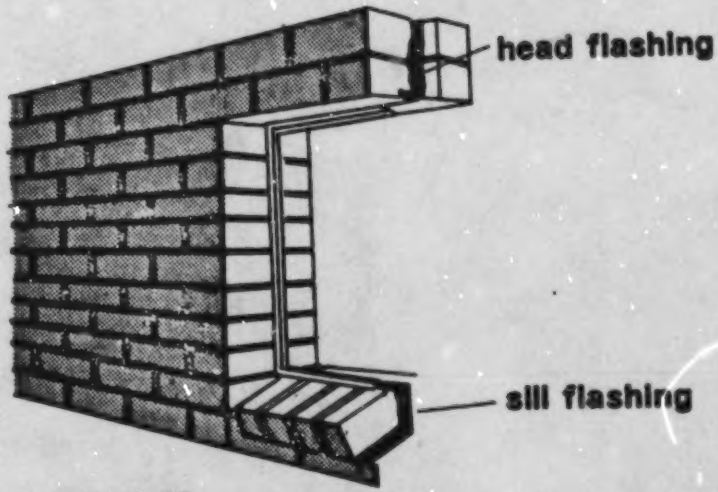
CONCRETE LINTEL



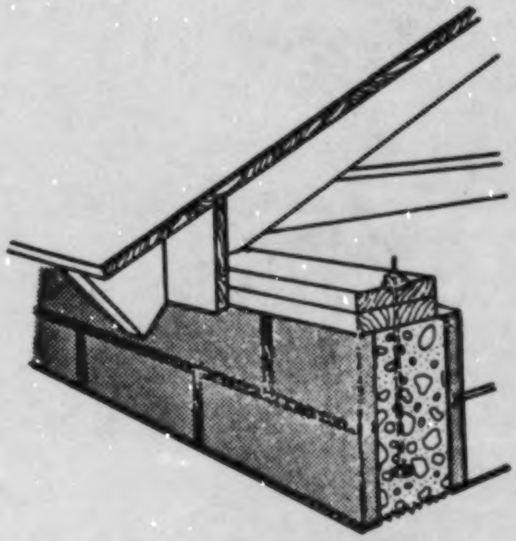
STEEL-T LINTEL


WIRE MESH TIE

MASONRY WALLS


head flashing
sill flashing

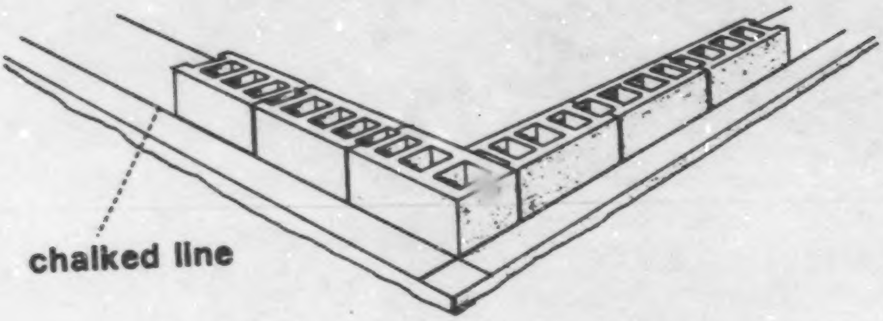
FLASHING

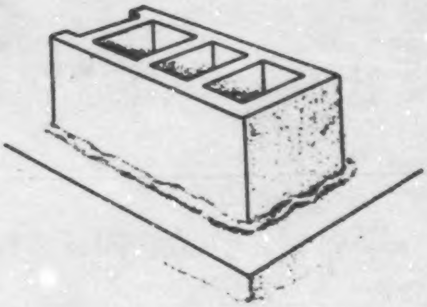


ANCHOR BOLT

LAYING MASONRY UNITS

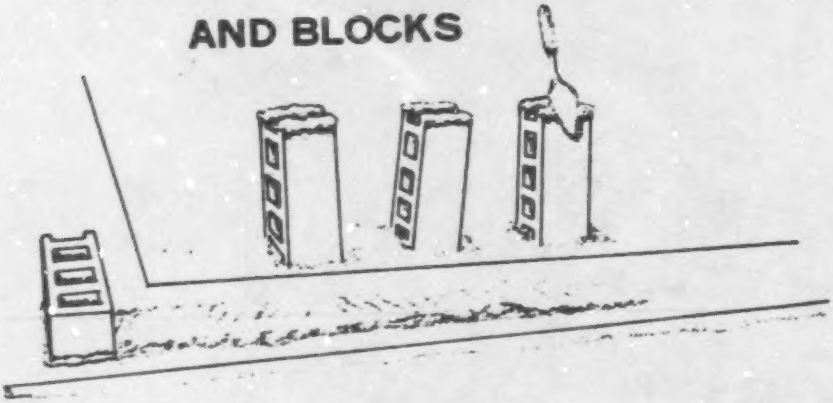
ALIGNING FIRST COURSE

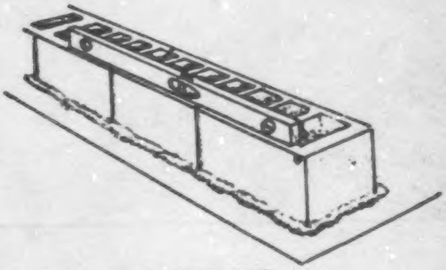




LAY CORNER BLOCK

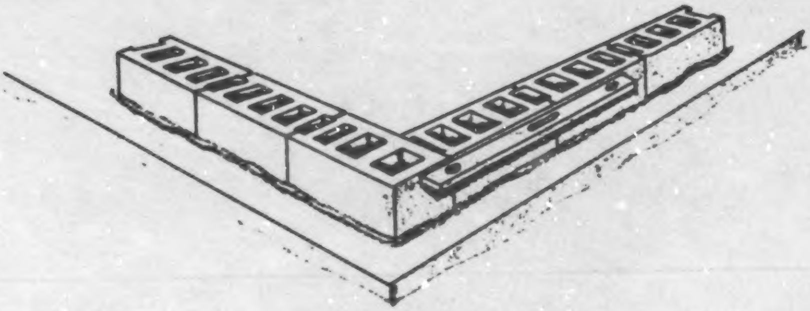
APPLY MORTAR TO FOUNDATION AND BLOCKS



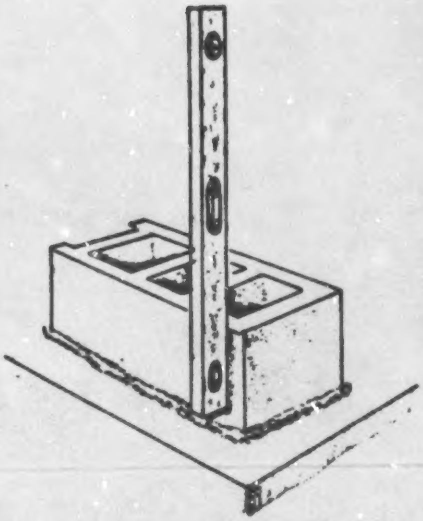


LEVEL BLOCKS

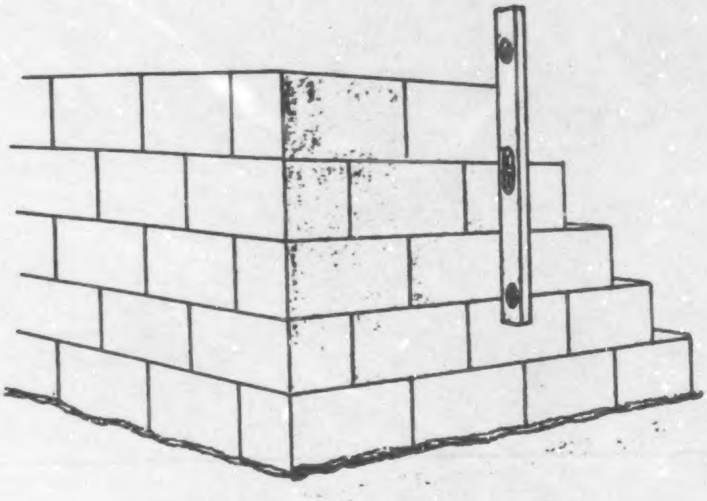
LAYING MASONRY UNITS



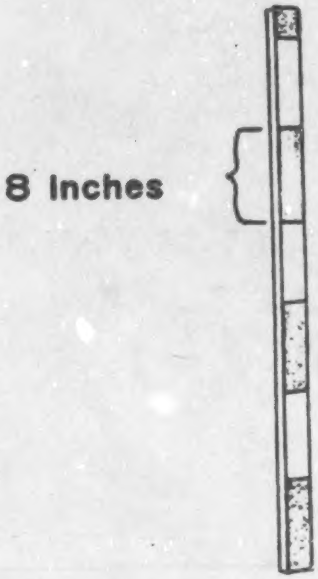
ALIGN BLOCKS WITH LEVEL



PLUMB FIRST COURSE

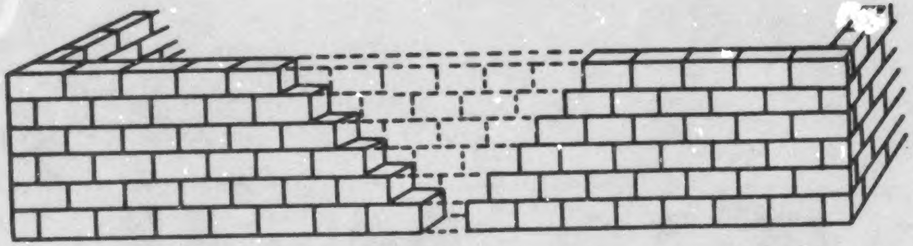


CHECK PLANE OF WALL-
PLUMB WALL

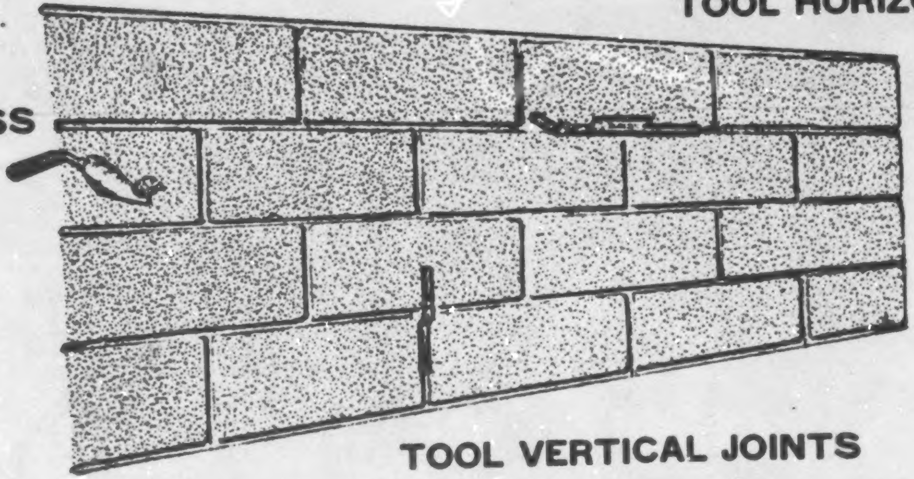


COURSE POLE

LAYING MASONRY UNITS



CLOSE CENTER BETWEEN CORNERS

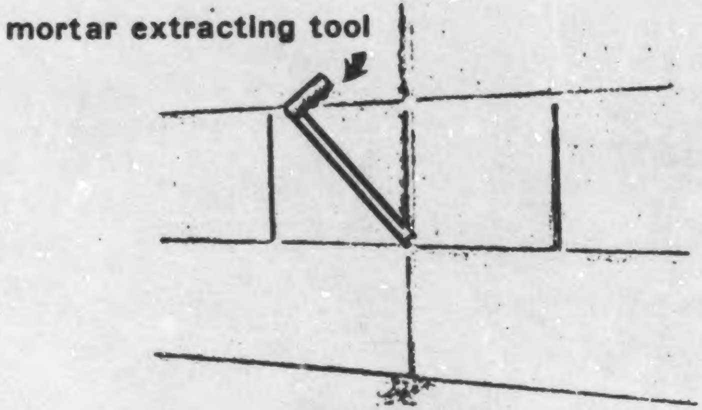


TOOL HORIZONTAL JOINTS

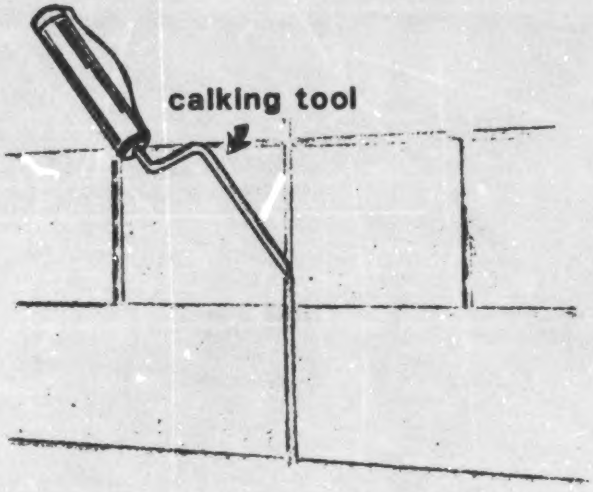
REMOVE EXCESS MORTAR

TOOL VERTICAL JOINTS

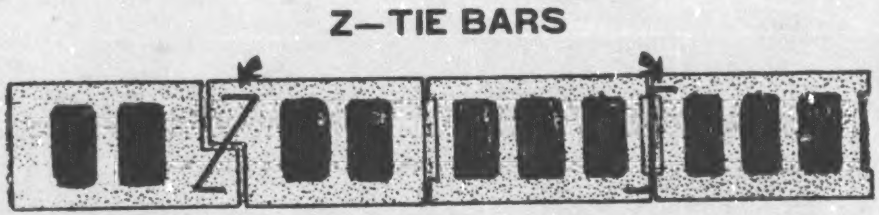
LAYING MASONRY UNITS


mortar extracting tool

MAKE CONTROL JOINT—
REMOVE MORTAR


calking tool

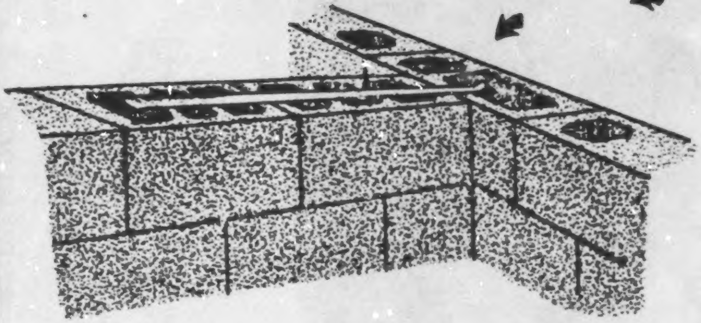
CALK JOINT



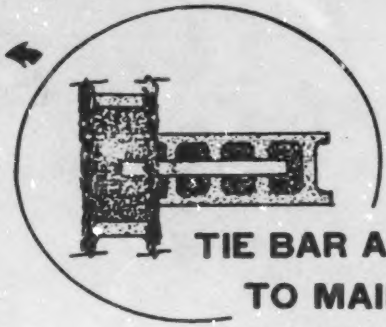
JAMB BLOCKS FORM
CONTROL JOINT

REGULAR CONTROL JOINT

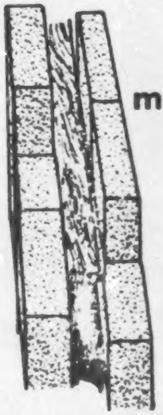
LAYING MASONRY UNITS



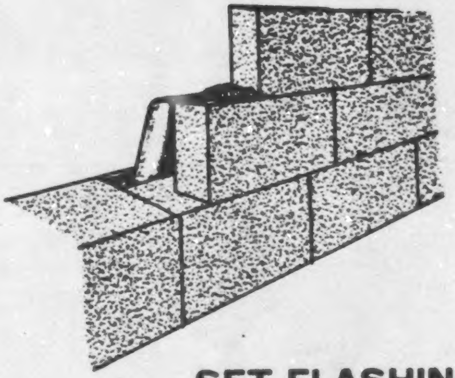
CONNECTING SUPPORTING WALL WITH TIE BAR



TIE BAR ANCHORED TO MAIN WALL

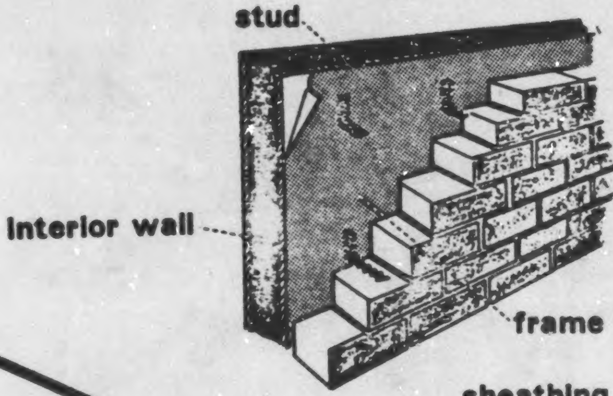

mortar dropping board

CAVITY WALL

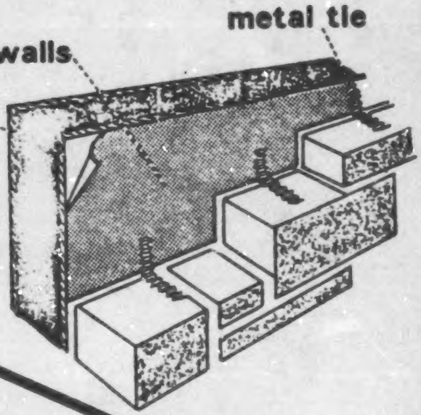


SET FLASHING ON FOUNDATION WALL

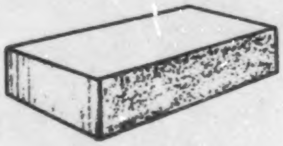
LAYING MASONRY UNITS


stud
interior wall

BRICK VENEER

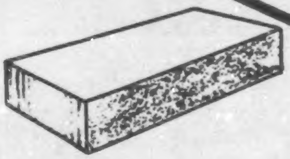

frame walls
metal tie
sheathing

ROCK VENEER

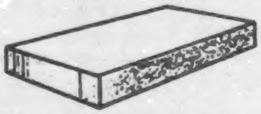


STANDARD BRICK

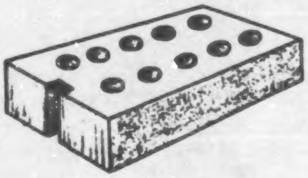
TYPES OF BRICK



NORMAN BRICK



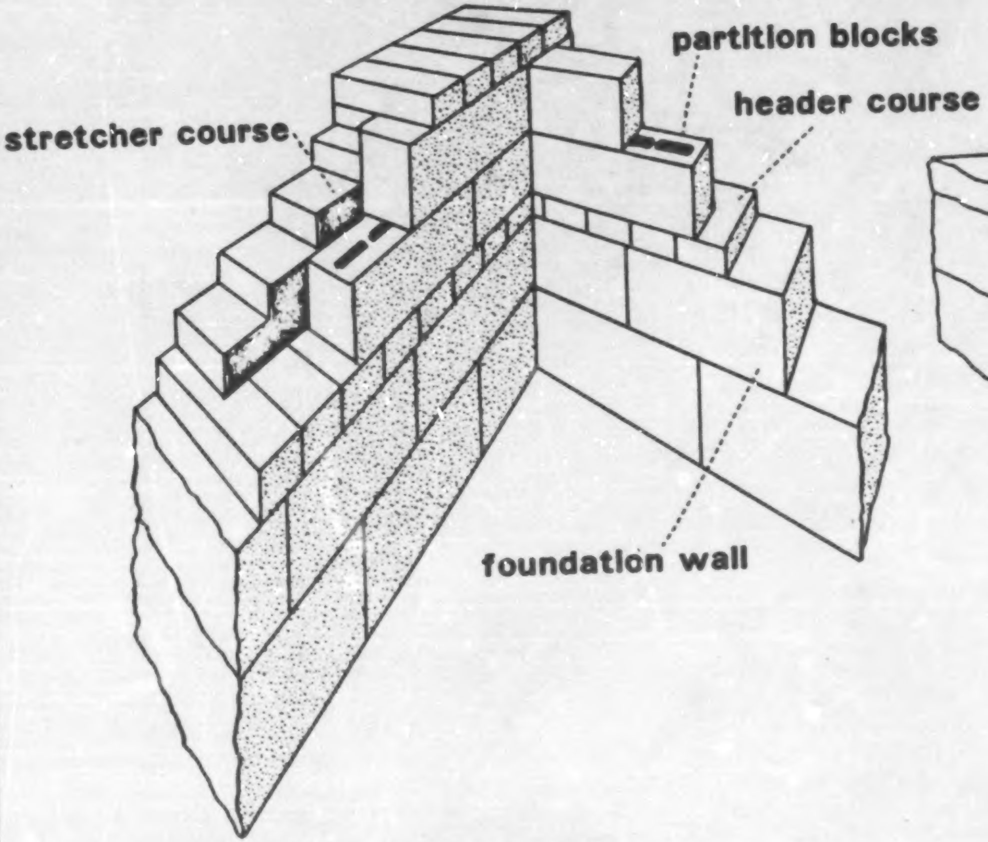
ROMAN BRICK

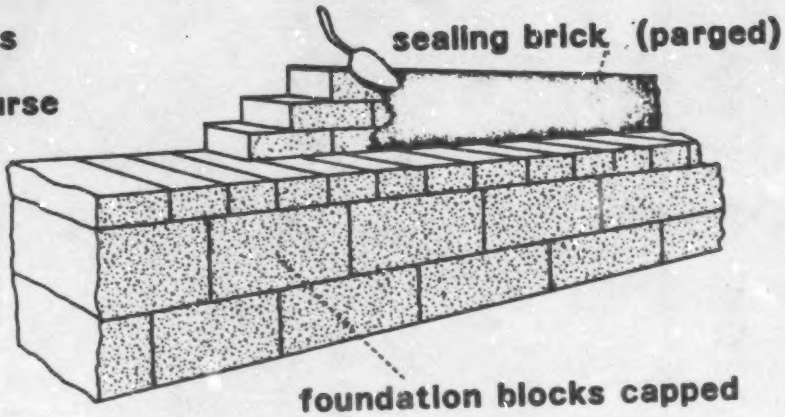


"SCR" BRICK

LAYING MASONRY UNITS

MASONRY WALL WITH BRICK

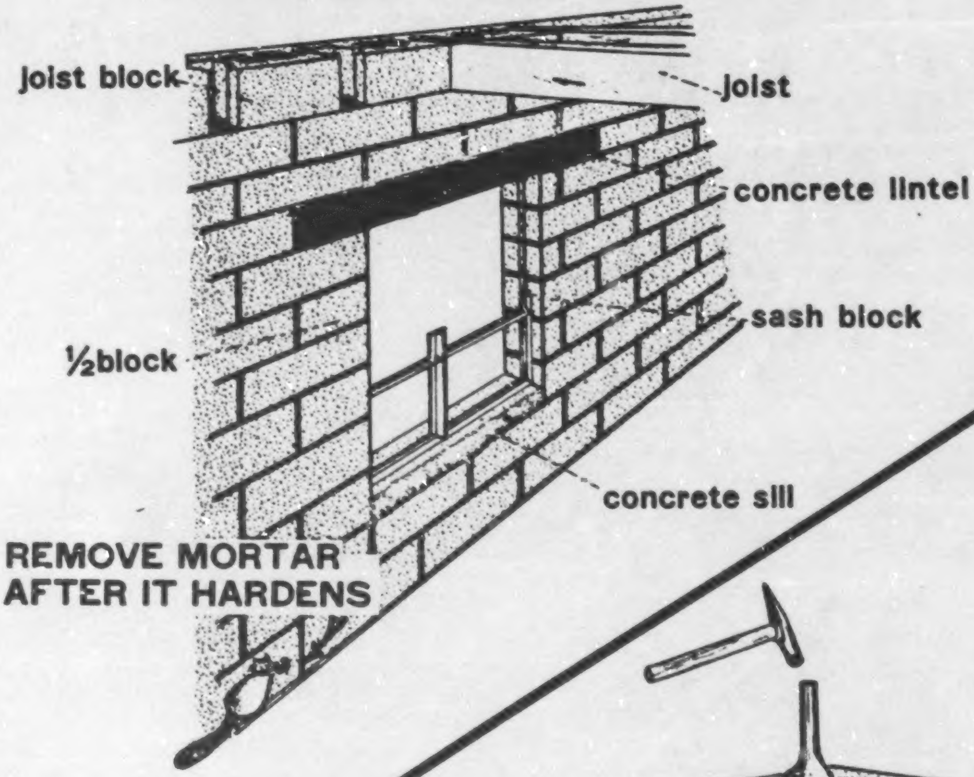

partition blocks
header course
stretcher course
foundation wall

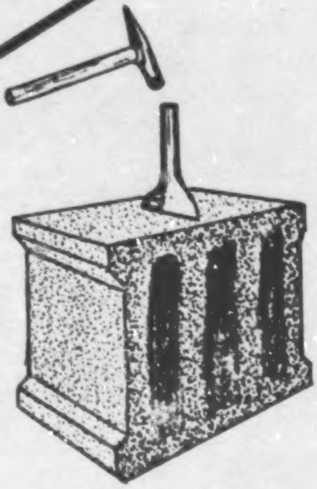

sealing brick (parged)
foundation blocks capped

SEAL INSIDE BRICK AND CHECK ALIGNMENT

LAYING MASONRY UNITS

CONCRETE MASONRY WALL


joist block
joist
concrete lintel
sash block
½block
concrete sill
REMOVE MORTAR AFTER IT HARDENS



CUT MASONRY UNITS WITH CHISEL & HAMMER

Agriculture Building Construction

Unit VI: Advantages of Metal Roofing and Siding

Farm structures are traditionally built of materials that are readily available and low in cost. When wood was both plentiful and cheap the local saw mill or lumber yard provided the wood for farm buildings. With the exception of stone foundations, many buildings were made entirely of wood, the framework of wood timbers, the siding and partitions of boards and the roof of wood shingles.

Metal has gradually replaced wood and many farm buildings today are built entirely of steel. Others have wooden frames and are covered with aluminum, galvanized, or painted steel. The farm accounts for about 10% of the metal buildings constructed today. The high cost of modern farm tractors and machinery and the high value of livestock and grain make it imperative that they be protected with good storage buildings.

Low overall cost

The cost of metal roofing and siding is generally much less than other building materials because it costs far less to apply. The maintenance cost for metal roofing and siding is moderate and insurance rates are frequently lower on buildings covered with metal.

Lower application cost

Metal roofing and siding can be applied quickly and easily. The roofing requires no building paper or sheathing. Less supporting materials are needed and purlins can be used instead of sheathing. Metal roofing and siding can be satisfactorily applied by semi-skilled labor.

Storm proof

If metal roofing is applied properly, normal rain, snow, and wind storms will not damage it. Aluminum roofing is sometimes damaged by severe hail storms. The pattern in the metal roofing helps compensate for expansion and contraction when there are marked temperature changes.

Strong and rugged

Metal siding can take some abuse and hard knocks from livestock and equipment without harming the material. The roof can carry heavy snow and ice loads without sagging.

Fire resistant

Metal roofing and siding provides maximum protection against the start and spread of fire. Metal will not burn. This provides some peace of mind to the owner and generally will allow the owner to qualify for lower insurance rates.

Heat protection

In shelters for livestock and poultry, heat protection is important. Research studies have shown that metal roofing painted white reflects heat more effectively than almost any other roofing material.

There is a further advantage for the heat reflectivity of aluminum over painted steel.

Vermin-proof

Rats, mice, squirrels, and termites cannot penetrate steel roofing.

Low maintenance cost

If the metal roofing is galvanized steel, the original zinc coating will last for many years depending on the atmosphere. Painted metal roofing should be selected based on the reputation of the coating applied by the manufacturer.

Aluminum roofing will not rust. If the enamel is scraped off of aluminum it should be touched up with paint to restore the appearance but it will not rust. In effect, aluminum reduces paint and upkeep costs.

Attractive appearance

The uniform design and color of metal roofing and siding give the owner a building that is a source of pride and one that adds to the value of the farm.

Versatile

Metal roofing and siding can be used on any type of farm building construction: conventional woodframe, rigid frame, pole frame, and steel frame buildings.

Variety of application

Metal roofing also provides an effective vapor barrier for interior ceilings and wall linings and has been used successfully as pen dividers in livestock buildings. Metal roofing has been used as sideboards for trucks and wagons to increase the size of the load, as covering for doors, as a portable chute for unloading feed or concrete, as snow fencing, as downspouts for water drains, as protective skirting around buildings and mobile homes as well as hundreds of applications as shelters from wind and sun.

Unit VII: Selecting Metal Roofing and Siding

Gage

When metal workers discuss steel or sheet metal, they refer to its gage. The larger the number of the gage, the thinner the sheet and the less it weighs per square foot. For instance, a number 16 gage galvanized sheet is about 1/16th of an inch thick and weighs a little more than 2½ lbs. per square foot. A number 28 gage galvanized sheet is only 1/64th of an inch thick and weighs only about 3/4th of a pound per square foot. With a few exceptions, galvanized sheets lighter than number 28 or 29 gage should not be used for roofing purposes.

The largest part of the cost of any roof is the cost of labor, regardless of whether you do the work yourself, or hire it done. This labor cost will be practically the same regardless of the thickness of metal used. The few extra dollars required for the thicker material will be returned to you in extra years of trouble free service. Remember, the smaller the number of the gage, the thicker the metal.

Occasionally, there are slightly imperfect blemished sheets of galvanized roofing for sale. These are sometimes called "seconds." While some of these seconds are satisfactory, as a purchaser you should realize that there may be imperfections and blemishes that you cannot detect.

The thickness of aluminum roofing and siding is determined by the size of the sheet. Much of the material sold in the midwest measures .018 inches with a micrometer.

Pattern

There are a variety of patterns of metal roofing. Some of these are known as triple drain, 2½-inch corrugated, 1¼-inch corrugated, 3V-crimp, 5V-crimp and other proprietary patterns of ribbed metal.

The key is a good anti-siphon edge drain of some type. Most of the proprietary patterns sold today have an anti-siphon feature on the edge of the sheet.

Corrugated roofing is made from flat sheets that have been formed into a series of alternate ridges and grooves, or hills and valleys, that run in the same direction.

The reason for corrugating the sheets is to give them greater stiffness and load-carrying ability. The 2½-inch corrugated will carry two times the amount of water that a 1¼-inch corrugated roof will carry. On a roof with open slats or purlins, the 2½-inch corrugated roofing provides greater strength because of its greater stiffness. Both types are widely used, and personal taste sometimes determines the choice.

V-crimped roofing is made from flat sheets by forming ridges that look like the letter "V" turned upside down. When only one crimp occurs at each edge, it is known as a 2V-crimp. When another crimp is placed in the center of the sheet, it is called 3V-crimp, and a still more common type uses a double crimp along each edge. These extra crimps provide greater stiffness and offer further protection against rain or snow being blown under the joints. Each pattern is superior to other patterns for some application.

The type of metal roofing best adapted to any particular building is determined somewhat by both the pitch of the roof and the condition of the building.

If it is a re-roofing job, if the old roof is wood or asphalt shingles that are still in such condition that they may be nailed down flat, they may be left on the roof if desired. The types of steel roofing for such conditions in the order of preference are triple drain, V-crimp, or 1¼-inch corrugated. If the old deck is of the open slat type, with the slats more than five inches apart, the preferred type is 1¼-inch corrugated.

If a new roof deck is to be built, there are some other factors which largely determine the best type of roofing to use.

Consult with the roofing supplier for recommended purlin and girt spacings, etc. Metal roofing and siding can be used on almost any type of building construction.

Weight of zinc coating

Galvanized sheets are zinc coated steel. The zinc coating provides rust protection.

The zinc coating is measured in ounces per square foot. Essentially all galvanized sheets are manufactured in the United States to specifications of the American Society for Testing and Materials, (ASTM). The most commonly used metal for roofing and siding are sheets manufactured to ASTM A-361 standards and carry a 1.25-ounce per square foot coating. Roofing with a two-ounce coating is designated as the "Zinc Institute Seal of Quality."

The galvanized roofing is manufactured with various weights of coating. A small difference in the weight of the zinc coating means a great difference in the length of service. The thicker the zinc coating the longer the life before rusting. It may be necessary to request a heavier coating because suppliers typically stock only materials with 1.25-ounce coating.

Pitch recommendations

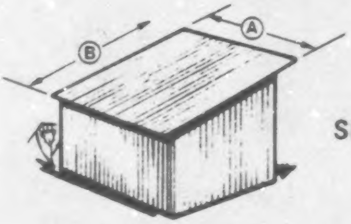
If you design your building for metal roofing, you can take advantage of the open deck type of roof construction. Metal sheets are recommended for roofs that slope four inches or more per foot. Roofs flatter than this may leak at the laps or joints between the sheets. Standard metal roofing sheets are not recommended for flat roofs. Corrugated roofing should never be used on a pitch of less than three inches per foot. Consult with the manufacturer for recommended roof slopes for different proprietary patterns.

The slope or pitch of the roof regulates the speed with which the rain water or wet snow drains from the surface. The slope therefore influences the decision as to what type of roofing should be adapted to a particular building. If the run-off is slow and the water tends to pond or flood the roof, then the water will leak through the joints, and once the moisture migrates through, it will tend to continue to siphon to the inside of the building by capillary migration. A wind blowing against the roof will tend to force the water through the joints or the partial vacuum created may tend to draw the water through the joints.

Estimating roofing and siding needs

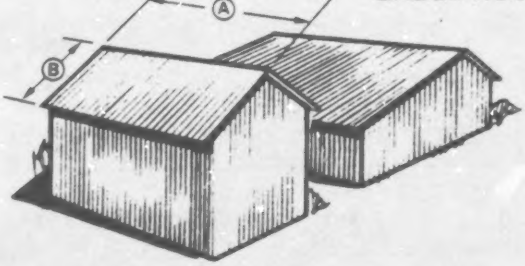
To estimate the amount of roofing and siding needed for a building, determine the number of sheets needed for each surface of the structure and add them together.

Shed type. For a shed type roof (Fig. 3), divide distance "A" by 2 (24", or 2-foot, sheet cover width after side lap allowance) to get number of sheets per row. If distance "B" is 30' or less, one row of this sheet length is sufficient; if it is over 30', or if two rows are preferred, select two sheet lengths whose combined length equals distance "B" (depending upon slope, allow 6" to 8" end lap between rows; also add 3" overhand at eaves for drip edges). Multiply number of sheets per row by number of rows to determine total number of sheets. If different sheet lengths are needed, list number of each separately.



SHED ROOF

GABLE ROOF



SIDING

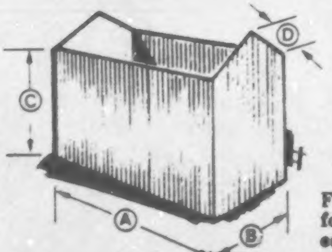


Fig. 3. To estimate the amount of roofing and siding needed for a building, determine the number of sheets needed for each surface of the structure and add them all together.

Gable type. For a gable roof, figure number of sheets for one surface same as shed type; multiply by 2 if both sides are same size, but add together if sides are different in size.

For siding, divide distances "A" and "B" by 2 to get number of sheets for one side and one end, and multiply by 2 to get number of sheets for both sides and ends - all at distance "C" length. Divide distance "B" by 2 to get number of sheets for one gable and at distance "D" length, and multiply by 2 to get number of sheets for both gable ends. List number of each sheet length separately. Table II gives common lengths of roofing sheets.

Table II. SHEET AREAS OF METAL ROOFING

Sheet Length (feet)	26" Wide (1¼" or 2½" corrugated) Area per Sheet (sq. ft.)	26" Wide (1¼" or 2½" corrugated) Sheets per Square	27½" Wide (2½" corrugated) Area per Sheet (sq. ft.)	27½" Wide (2½" corrugated) Sheets per Square
6	13.000	7.692	13.750	7.273
7	15.167	6.593	16.042	6.234
8	17.333	5.769	18.333	5.455
9	19.500	5.128	20.625	4.849
10	21.667	4.615	22.917	4.364
11	23.833	4.196	25.208	3.967
12	26.000	3.846	27.500	3.636
13	28.167	3.550	29.792	3.357
14	30.333	3.297	32.083	3.117
15	32.500	3.077	34.375	2.909
16	34.667	2.885	36.667	2.727
17	36.833	2.715	38.958	2.567
18	39.000	2.564	41.250	2.424
19	41.167	2.429	43.542	2.297
20	43.333	2.308	45.833	2.182
21	45.500	2.198	48.125	2.078
22	47.667	2.098	50.417	1.984
23	49.833	2.007	52.708	1.897
24	52.000	1.923	55.000	1.818
25	54.167	1.846	57.292	1.745
26	56.333	1.775	59.583	1.678
27	58.500	1.709	61.875	1.616
28	60.667	1.648	64.167	1.558
29	62.833	1.592	66.458	1.505
30	65.000	1.539	68.750	1.455

Since the exposed covering width of most types of formed roofing is 2 feet, it is often necessary to project the eave length of the roof to the next higher even foot, so that the number of sheets can be figured more easily. For example, if the true eave measurement (length of eave from one gable end to the other) is 31 feet, 4 inches, this should be projected to an eave length of 32 feet, so that upon dividing the eave length by two, the result is an even 16 sheets. Fifteen sheets would not be enough to reach from one gable end to the other, and if the sheets are made in 2-foot widths, it is necessary to figure on the basis of a 32-foot eave length.

If roofing and siding sheets cover 30 inches, 36 inches or 48 inches, you must adjust your calculations accordingly.

Unit VIII: Storing Roofing and Siding

Many times when you are planning a new building or planning to remodel an older building, you will have an opportunity to purchase metal roofing and siding at reduced prices. If you buy this material before you can use it, you must store it properly to have a quality product when you need it.

Break open the bundles of metal roofing and stand them on end against interior walls. They should be spread out at the bottom to allow for air circulation.

If the galvanized metal roofing or siding is to be stored for a short time, it may be left in bundles but it should be covered with a canvas tarpaulin, not a plastic sheet. It should always be stored on blocks to protect the bottom sheets from ground moisture.

If galvanized metal roofing is stored in bundles, condensation causes moisture to collect and it remains trapped between the sheets. This causes the formation of zinc oxide which is called "wet storage stain." This detracts from the appearance of the finished structure and shortens the time before starting to rust. Aluminum roofing will not rust but unsightly discoloration can be a problem.

Be sure sheets are free of this oxidation when purchased and store them properly if they are not to be used immediately.

Unit IX: Applying Roofing and Siding

Safety considerations

The application of roofing and siding requires that you give some thought to the safety of those working on the structure. If electrical tools are used, be sure the circuits are GFI protected. Be careful when handling sheets that they do not contact overhead power lines.

Use care when climbing on ladders and scaffolding. Be sure that ladders are always securely placed. Do not overreach when working on ladders. Wear shoes that will not slip on the metal roofing. Do not wear ragged clothing. You may wish to wear some devices to protect you from the noise of nailing. Wear a hard hat or bump cap.

Metal roofing can be cut with power shears or portable electric saws. Be especially careful when handling cut sheets. Leather gloves may prevent cut hands.

Safety glasses should be worn when nailing roofing and siding as well as when using power saws or shears.

Give some thought to the hazards of handling metal roofing and siding on windy days. It is difficult to appreciate the effect of wind against large sheets of metal.

When using a power saw, cut painted roofing from the interior (bottom) side to prevent damage from hot shavings to painted (top) surface. Wipe all shavings from both surfaces before installation.

The most satisfactory and economical service from metal roofing and siding can be assured if you give some attention to the following points: (1) Providing a sound roof structure; (2) Laying sheets properly; (e) Lapping the sheets adequately; (4) Using the right fasteners; (5) Locating the fasteners correctly; (6) Providing enough fasteners; (7) Applying siding; (8) Using correct accessories; (9) Following manufacturer's recommendations.

Providing a sound roof structure

There are two general types of roof decks on which metal roofing may be applied: a tight deck and an open deck. The tight deck consists of plywood applied to rafters, rigid frames, or trusses. The open deck is often the most economical roof structure and it consists of purlins nailed to the upper cords of trusses, rigid frames, or rafters. These are usually 2" x 3" or 2" x 4" members.

The spacing of these purlins can best be determined by laying two pieces of wood on the ground the same distance apart as the roof rafters and placing upon them boards or light timbers at different distances apart under a sample sheet of corrugated roofing. The stiffness of the sheet under the weight of a man will furnish a good guide for the proper spacing of purlins in the roof deck. In no case should the spacing be so wide as to result in damage to the roofing when walked upon. Normally this spacing is two feet on center or less. Consult tables provided by the manufacturer for deflection from loads applied at different purlin or girt spacings. If the span is too great, the load deflection may separate the sheets on side laps and cause leaks. If this occurs, it will require the use of sheet metal screws to draw the sheets together.

It is essential that the roof deck be of sound lumber. If you are using salvaged lumber, be sure it is free from rot, and firmly attached to the supporting rafters, trusses or other framework. Some building manufacturers recommend that 2 x 4 purlins be placed on edge. Framing anchors should be used to attach these purlins to rafters or trusses. When two-inch lumber is nailed flat to the edge of two-inch (2" x 4", 2" x 6", or 2" x 8") rafters, it is recommended that 16 penny nails be used.

For best results, use 2-inch roofing girts. Nails in 2-inch roofing girts hold about 50% more than in 1-inch wood.

Laying sheets properly

Start laying sheets at the lower corner away from prevailing winds. This will help the wind, rain, and snow to blow over and not under the laps in the roofing. Extend the sheet with its edge down at least one corrugation over the gable end and allow 3 inches of ove hang at the eaves. Use extra care when laying the first sheet. Be sure it is square with the roof and properly located.

The corrugated patterns of roofing are usually applied one course at a time from gable end to gable end and always starting at the eave rather than the ridge. If the roof slope is 30 feet long or less, only one horizontal row of sheets is needed. If the ridge of the roof runs north and south and the prevailing storms come from a northerly direction, start applying the sheets of roofing at the southern gable end of the roof and apply the first course all the way to the northern gable end of the roof.

In some sections, it is the local custom to apply corrugated sheets one row at a time from the eave to the ridge.

Some roofers prefer to stretch a chalk line across the eave to be sure that the sheets of roofing are applied squarely to the building and do not run progressively up toward the ridge or extend off the eave. It is very easy for roofing to be applied crooked if one person drives the nails tighter than another. Each sheet of roofing tends to become fan-shaped with one end wider than the other, and the entire row of roofing sheets tends to curve.

To keep labor at a minimum, store roofing and siding sheets in a wagon or truck so they can be moved along the structure as the work progresses.

Exercise care when handling metal roofing on windy days. Be sure that loose roofing sheets are not blown off the roof.

Lapping the sheets adequately

When applying all types of formed metal roofing sheets, good construction procedure demands that the sheet project sufficiently over both gable ends so that it can be bent down over the wood deck. This serves to protect the wood from the weather and keeps it from rotting. This projection is referred to as "gable end drip edge." The roofing that extends over the eaves is known as "eave drip edge." This extension should be at least three inches unless you plan to install gutters.

Good construction also requires that the edges of the sheets overlap one another so that no leakage occurs. These laps are referred to as "side laps" and end laps." The proper use of either of these expressions depends upon whether it is the side of the sheet that is being lapped or the end of the sheet.

Because of the side laps, 2½-inch corrugated roofing sheets which measure 27½ inches wide from edge to edge, have a net width exposure to the weather of 24 inches. The remaining 3½ inches of width is taken up with the side laps. When determining the number of sheets needed from eave to the ridge, it is necessary to figure the amount of each sheet devoted to end lap. The proper dimensions for gable and eave drip edges and side and end laps are given in the detailed directions for the application of any of the various types of steel roofing. The side lap for proprietary patterns is designated by the manufacturer (Fig. 10). The side lap for corrugated roofing should be at least 1½ corrugations. The end lap should be 6 inches when the roof slope is 5" or more rise per foot. The end lap should be 8 inches when the roof slope is four inches rise per foot of run. If the slope is less, use caulking or sealant.

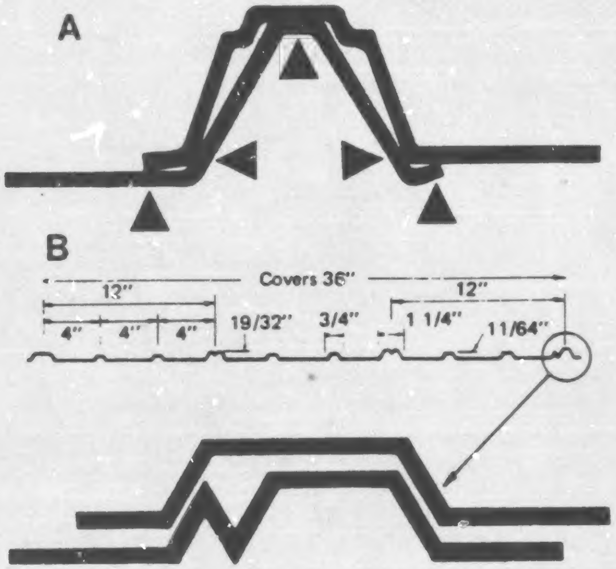


Fig. 10. The side lap for one brand of aluminum roofing is shown in A. The seal points are shown by arrows. The channels prevent siphoning. One pattern of steel roofing is shown in B and the pattern provides an anti-siphon feature.

Using the right fasteners

Fasten metal roofing and siding securely with ring- or screw-shank nails or drill screws (Fig. 11). Set nails just off-center through the peak or top of the roofing for corrugated sheets. Do not drive nails in the valley or the roof will leak like a sieve. Leave the valleys open for efficient drainage. Drive the nail at a slight angle to increase the holding power and to tighten the side lap (Fig. 12). Drive the nail just far enough to set the sheet tight against the purlin. If you drive the nail too far you will damage the head or washer, flatten the corrugation, and misalign the sheet. If you do not drive the nail down securely, the roofing will be loose.

Nail the side ribs first then the center of the sheet. This will eliminate problems of spreading or creeping. Do not nail the drain edge of a sheet until it is side-lapped by the adjacent sheet.

When it is necessary to nail through four sheets (as corner laps on two-row roofs), use an awl or drill to start the nail if necessary. Some builders prefer to do this when nailing through two sheets on side or end laps if heavy gage sheets are used.

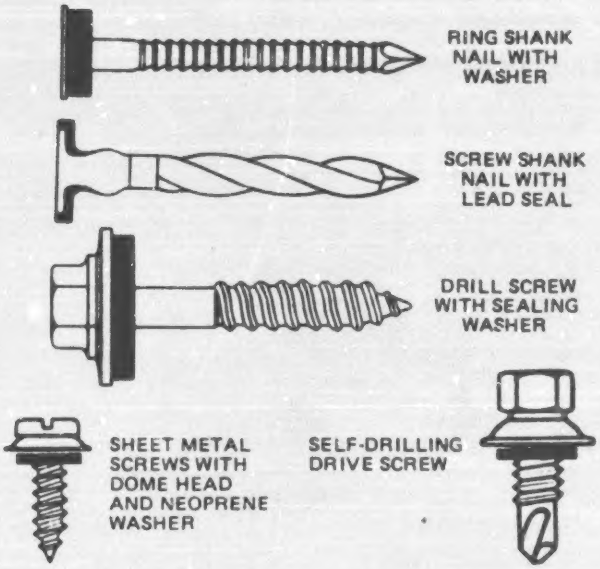

RING SHANK NAIL WITH WASHER
SCREW SHANK NAIL WITH LEAD SEAL
DRILL SCREW WITH SEALING WASHER
SHEET METAL SCREWS WITH DOME HEAD AND NEOPRENE WASHER
SELF-DRILLING DRIVE SCREW

Fig. 11. Use nails or drive screws that seal with lead, neoprene, or rubber washers to prevent leakage.

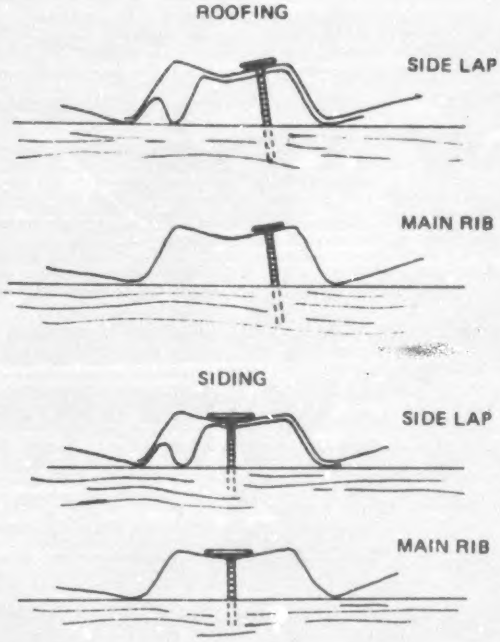

ROOFING
SIDE LAP
MAIN RIB
SIDING
SIDE LAP
MAIN RIB

Fig. 12. Manufacturers recommend specific nailing procedures for their patterns of roofing and siding. This illustration shows a typical recommendation for nailing roofing and siding.

If a nail misses a purlin, pull it out and close the hole with sealer and a sheet metal screw.

For steel roofing, use lead head zinc coated nails or nails with neoprene washers. Use aluminum nails with neoprene washers for aluminum roofs.

Choose nails with enough length to give adequate holding power but which do not go all the way through the purlin. If the facing boards on the gables are one-inch lumber, the nails should not be as long as when nailing to two-inch purlins. If insulation is used, increase the nail length accordingly.

Nail sheets every three inches at the gable end. Nail sheets about every 5 inches at the eaves.

For V-crimp roofing, drive nails in the top of the V. For 1¼" x ½" corrugated roofing 26" wide, drive nails in every fifth corrugation. This is about 124 nails per square (100 sq. ft.) when purlins are spaced 24" (Fig. 13). Use 1 3/4" nails for 2" x 4" purlins and 1½" nails for 2" x 4" sidewall girts.

For 2½" x ½" corrugated roofing 27½" wide, drive nails in every third corrugation. This is about 96 nails per square when purlins are spaced 24". Use 2" nails for 2" x 4" roof purlins and 1 3/4" nails for sidewall girts.

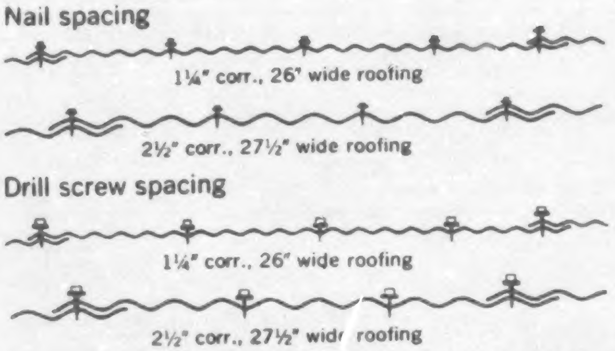

Nail spacing
1¼" corr., 26" wide roofing
2½" corr., 27½" wide roofing
Drill screw spacing
1¼" corr., 26" wide roofing
2½" corr., 27½" wide roofing

Fig. 13. Space nails and drill screws the same but note that drill screws are only set in the peak of the corrugation on side laps. Other applications of drill screws are in the valleys.

The exact location of the nails is determined by the design of the roof foundation, rafters, sheating, and nailing girts. Table III gives the approximate number of nails per pound.

Table III. NUMBER OF NAILS PER POUND

Length of nail	Number per pound
1½"	90
1¾"	85
2"	80
2¼"	75
2½"	70

Drill screws with sealing washers are widely used. They are self-drilling and self-seating with power drivers. They are available in carbon steel for galvanized roofing and siding and stainless steel or aluminum for aluminum roofing and siding. Colors that match or contrast with colored roofing and siding may be used. These should be applied vertically in the valleys. Use 3/4" - 1" screws for one-inch sheathing and 1½" screws on two-inch sheathing. When insulation is used increase the length of the drill screw accordingly (Fig. 14). These screws draw the sheets tight to the purlins. When they are used for side laps, they are set in the peak of the corrugation.

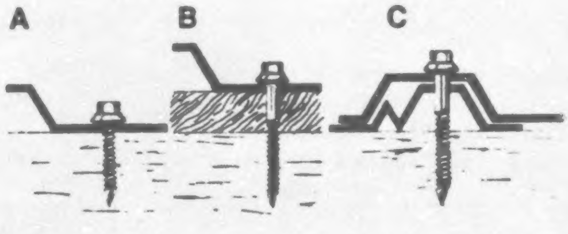


Fig. 14. Use ¾"-1" drive screws for fastening valleys (A). If ½" insulation is used under the roofing use 1½" screws (B). Use 1½" screws for fastening crown laps (C).

Space drill screws in every fifth corrugation valley on 26" roofing with 1¼" x ¼" corrugations. This is 126 per square. For 2½" x ½" corrugated roofing 27" wide, place the drill screws in every third corrugation valley. This is 96 per square for purlins spaced 24" apart.

Sheet metal screws have several uses when applying metal roofing and siding so it is advisable to carry some in your nail apron and have a screw driver and an awl handy. Sheet metal screws are used to draw roofing sheets together tightly at the side lap or when separation occurs by buckling along the edge of the upper sheet. When purlins are spaced 30" apart, there is apt to be separation along side laps so these screws are used to draw the sheets together.

Occasionally a nail will strike a knot and bend or miss a purlin or girt. Use a sheet metal screw with sealer to fill the hole in the roofing or siding.

Applying siding

Space the wall girts or nailers from 36" to 48" apart.

The 1¼" x ¼" corrugated roofing and siding is finished with one edge up and one edge down. The 2½" x ½" corrugated is finished with both edges down. The 27½ inch roofing is suggested in preference to the 26" width for siding.

Start applying sheets vertically at a corner of the side wall, downwind from the prevailing wind (Fig. 15).

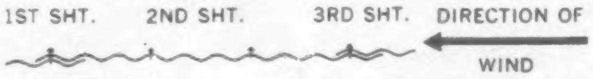


Fig. 15. Apply the sheets vertically with the first sheet downwind or away from the prevailing wind.

Use extra care with the first sheet. Be sure it is plumb or square with the corner so that the rest of the sheets will be aligned correctly. One way to do this is to tack a 2" x 4" horizontally, 6" below the top of the baseboard. Keep this 2" x 4" level or parallel to the place. Rest the siding sheets on this strip, side lap them, and fasten them to the girts.

Attach the first sheet with its edge down at the corner. It will not be necessary to lap since the sheets are available in even-numbered feet from 6 to 30 feet (Table IV).

It may be necessary to notch sheets at the upper end for rafters. This will prevent wind, snow, and birds from entering, if these notches are carefully cut.

Table IV. CORRUGATED ROOFING SHEET SIZES

Corrugation Pattern	Sheet Width	Corrugations per Sheet	Cover Width	Even-Foot Lengths
1) 1¼" x ¼"	26"	20½	24"	6' through 30'
2) 2½" x ½"	26"	10	24"	6' through 30'
3) 2½" x ½"	27½"	10½	24"	6' through 30'

1) The 1¼" corrugated sheet finishes with one edge up and one edge down to give a 1½-corrugation side lap; it may be used for both roofing and siding.

2) The 26" wide, 2½" corrugated sheet finishes with both edges down; it is designed for siding, with a one-corrugation side lap. It may also be used for roofing by reversing, or turning over, every other sheet to provide the necessary 1½-corrugation side lap; this reduces the average cover width per sheet to 22¾".

3) The 27½" wide, 2½" corrugated sheet finishes with one edge up and one edge down; it is designed for roofing, with a 1½-corrugation side lap.

Metal siding can be bent for corners but it is usually just as easy to cut the sheet and re-start around the corner. Finish the corner by using metal trim.

If you are using nails to fasten the siding, drive them through every fifth corrugation valley for 1¼" x ¼" corrugated siding and every third corrugation valley for 2½" x ½" corrugated. Drill screws are applied in the valleys. Since the girt spacing is generally 36 inches, this will require 91 per square for 1¼" corrugations and 69 per square for 2½" corrugation.

Using correct accessories

A variety of accessories is available for trim and finish of the building exterior. Several types of ridge roll and ridge cap are available. End wall flashing covers the gap between a lean-to roof and a building wall. Rake and corner trim can be used at corners and doorways. Door track cover trim can be used over rolling door track.

Closure strips molded in the share of corrugated or ribbed metal are used to seal the interior of buildings from dust, water, and air. They are resistant to oil and heat and fit snugly without caulking. The strips are made of neoprene or other polymers. They are installed at the same time as the roofing and siding.

Providing lightning protection

The installation of a lightning protection system is not a task that you should attempt on your own. Use a person trained in the installation of this equipment to install it for you. The following information is provided to serve as a guide to help you understand and recognize a correct installation.

Some metal building manufacturers imply that all that is necessary is that the corners of the building be grounded. This is not true. Electrical continuity may be broken because of corrosion and displacement. Consult VAS 3011 on Lightning Protection or Sec. 214, NFPA Code 78 of the National Fire Code from the National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts, 02210.

Gutters and downspouts

Gutters on buildings serve these purposes: (1) They eliminate erosion of the ground below the eave line; (2) They eliminate one cause of water seepage into buildings around foundations; (3) Conserve water by collecting and directing it to proper storage areas.

Slope gutters 1/16" per foot. Be sure there are enough downspouts to drain the water from the roof area.

Skylights and windows

Translucent panels may be used for skylights instead of windows. Many owners feel that the panels are superior to windows because they are not as subject to vandalism and they prevent observation of the contents by prospective thieves.

Unit X: Repairing and Painting

Repairing

Good maintenance of roofs and buildings should include a periodic inspection, especially after hail storms or the buffeting of high winds. Look for loose sheets, tears at nail holes, and loosened nails. Look for places where livestock or equipment may have damaged the siding.

Leakage of roofs occurs generally at the side and end laps. Usually resetting nails or adding additional nails may prevent further leaking. If sheets tend to separate at the side lap, use sheet metal screws to draw them together.

When leakage occurs at enlarged nail holes, remove the old nails and plug the holes with large pan-head sheet metal screws. Renail the sheet with new nails in new locations.

Siphoning is often a cause of leaks at side laps if the roof floods and the wind is blowing. To stop the siphoning, insert a butyl sealant between the sheets. Loosen the side lap sheets, pry up the overlapping sheet and force sealant in a bead between the sheets. The bead should be about 3/16" in diameter. Reset the nails or screws and if the washers are damaged, replace them.

If the roofs have a low slope, use roofing with anti-siphon configuration along the edges.

If it is necessary to repair a roof following storm damage or when metal roofing is used to replace other roofing, nail all loose boards. Replace any decayed eave boards and remove all debris and projecting nails where the old roofing is torn off. It is not advisable to remove any more of the old roof than you can reasonably replace in the same day, especially during uncertain weather. Manufacturers of some roofing materials advocate the application of metal roofing over old roofs and metal roofing is often applied in this way.

For best results, it is recommended that the old roofing be removed and the new roof be placed on a clean deck, unless the old roof is of a kind that can be nailed down flat before the metal roofing is applied. If the old roof is of asbestos shingles, slate or tile, it should be removed. Placing a new metal roofing over an old deteriorated roof deck often results in a slip-shod job. The time saved by not removing the old or badly deteriorated roofing material may necessitate spending many extra dollars in subsequent repair and the appearance is often less than desirable. Remember that a good appearance increases the value of your property. The satisfaction of an attractive roof is also worth something.

If the existing roofing is aluminum, repair it with aluminum sheets. Do not mix aluminum and steel roofing sheets. The two metals are not compatible and have a corrosive effect on each other.

As part of a systematic maintenance of your buildings, look for evidence of rust and corrosion.

Corrosion protection

When metals are attacked by moisture or acids, they are said to corrode or oxidize. If the metal is steel, the oxide is rust and it has the familiar reddish brown color. If the metal is copper, the color is grayish green. If the metal is aluminum, the oxide is gray or black.

Zinc is unique among corrosion protective materials. Not only does the zinc serve as a barrier to seal out corrosive moisture, but it also provides additional protection through galvanic action. It actually sacrifices itself slowly to the corrosion to save the base metal from rust. Zinc prevents rather than cures the results of corrosion.

It is easy to understand the rust retarding action of a mechanical barrier because of its corrosion resistance, but it is more difficult to explain that, in the presence of moisture, two unlike metals form a galvanic cell and one will corrode more readily to protect the other.

When two dissimilar metals are in electrical contact in the presence of a conductive medium, galvanic corrosion of one takes place while the other is protected. Metals can be arranged according to their relative reactivity towards galvanic corrosion in the following Table V.

Table V. METALS IN GALVANIC SERIES

Corroded End (anodic or less noble)

Magnesium
Zinc
Aluminum
Cadmium
Iron or Steel
Stainless Steels (active)
Soft Solders
Tin
Lead
Nickel
Brass
Bronzes
Nickel-Copper Alloys
Copper
Stainless Steels (passive)
Silver Solder
Silver
Gold
Platinum

Protected End (cathodic or most noble)

Any one of these metals and alloys will theoretically corrode while offering protection to any other which is lower in the series, so long as both are electrically connected.

Any of these metals and alloys will corrode by offering protection to any other which is lower in the series, so long as both are electrically connected. Since zinc is more active in galvanic couples than iron and steel, it provides iron and steel with electolytic protection against rust. This protection is so effective that even though there may be a small exposed area on the base metal, the attack of the elements will be directed to the zinc and the protection will continue as long as sufficient zinc remains.

Metallic coatings can be applied these ways: (1) hot dipping, (2) electroplating, and (3) metalizing. Each of these processes has a specific application for which it is preferred.

Hot dipping is the most widely used method of applying zinc coatings to roofing and siding. This process involves pickling or cleaning the steel, and then immersing it in a bath of molten zinc.

Painting (Field Applied)

Paints also have an important function in corrosion prevention. Paints are frequently used to provide added protection to the metal surfaces as well as for decorative purposes. In addition to ordinary protective and decorative functions, they are used widely on farm buildings and roofs that must provide both a pleasing appearance and corrosion protection.

Paints made of zinc dust and zinc oxide provide excellent rust-inhibitive properties, adhesion, abrasion resistance, and so forth. They tend to act electrochemically in controlling corrosion.

Zinc dust-zinc oxide paints are widely used on galvanized steel because they are usually adherent to zinc. They are excellent as primers on partially rusted surfaces. The 80% zinc dust and 20% zinc oxide pigment mixture is known as metallic zinc paint. Zinc dust paints are considered to adhere best and resist peeling.

Some latex paints are especially formulated for metal roofing and are quite satisfactory for one coat application. Cement base paints are lowest in cost and provide good adhesion.

Paint quality is important because the time and labor to prepare for painting is the same whether the paint is of good or poor quality. It may be false economy to put on cheap paint of unknown quality.

Do not use aluminum paint directly on galvanized steel roofing as the two metals are not compatible and "bleeding" will occur. Do not use house or trim paints except as a finish coat over a recommended prime coat.

Preparation for painting includes tightening loose sheets, separated side laps and re-tightening loosened fasteners. Loosen rust or scale with a stiff wire brush. Remove loose dust, rust, manure, etc., with a stiff brush or broom. Use solvent to remove grease, oil or soot, and wash with industrial detergent and rinse with water.

The application of paint should only be done when the surface is dry and in warm (40°F) dry weather. Paint may be applied in at least three ways: (1) brushing, (2) spraying, and (3) rolling. By brushing, you will probably get the greatest coverage per gallon but it will take the most time and labor. Spraying will take the least time and labor but gives less coverage than brushing. Rolling with a long nap roller will require less time than brushing but it will give less coverage than spraying or brushing. If the ribs in siding and roofing are deep, a high pressure sprayer may be the only logical choice.

Agriculture Building Construction

Unit XI: General Information

In the early years of this country, most roofs were covered with wood or slate shingles. The asphalt roofing industry began marketing roll roofing in a small way in 1893. Acceptance of asphalt roofing products by the American public increased steadily so that by 1937 approximately 75% of all roofing being applied in the United States was asphalt. By 1946, according to a report by the U.S. Department of Commerce, asphalt roofing amounted to 85.9% of the total.

Asphalt roofing products have become popular because of their fire resistance, beauty, versatility, and economy.

Fire resistance

Asphalt roofing will resist the spread of fire due to flying sparks. Neither will it create flying brands to endanger other buildings. Its fire resistance is further increased through the application of nonflammable mineral granules commonly used to coat asphalt shingles and roll roofing.

Beauty

Asphalt roofing products are available in a wide range of styles, colors, and textures. The builder has a choice of types to suit his preference and achieve a harmonious relationship with other elements of the structure. Colors run the full range from black to sun-reflective white, in pure colors or blends, and in smooth surfaces or textures. Roof colors may be used by the skillful planner as the basis for color harmony with doors, windows, shutters, trim, and sidewalls.

Versatility

Good design requires that a building be planned for the purpose it is to serve, and that its elements contribute to this end. There are asphalt roofing products suitable for permanent buildings, where long-time protection is required; for temporary structures, such as a contractor's field office, designed for one or two season's service; and for other types of buildings that range between the two.

Asphalt roofing products can be applied to a variety of roof types and slopes and in new construction as well as reroofing and maintenance work. No other roofing materials possesses a greater versatility.

Economy

Asphalt roofing materials are economical to use because of (1) Low first cost of materials and long life in service; (2) Absence of necessity to paint or stain the material to obtain desired color effects; (3) Low cost of transportation due to widespread placement of manufacturing plants throughout the country; and (4) Low cost of application and maintenance. The skills required in laying various types of asphalt materials are not difficult to learn and are illustrated in this unit.

Unit XII: What Asphalt Roofing and Siding Products are Available?

Asphalt roofing and siding products may be classified broadly into three groups: (1) saturated felts; (2) roll roofing and siding; and (3) roofing and siding shingles.

Saturated felts

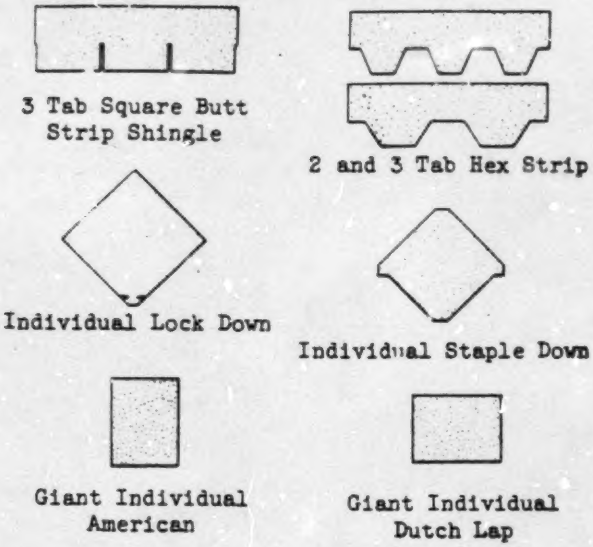
Saturated felts consist of dry felt impregnated with an asphalt or coal tar saturant, but otherwise untreated. They come in different weights, the most common being No. 15 and No. 30, weighing approximately 15 and 30 pounds per "square", respectively. A square is 100 square feet of surface plus a standard or average overlap. A standard roll of No. 15 felt is 3 feet wide and 144 feet long. This is 432 square feet and is intended to cover 4 squares or 400 square feet. The extra 8 square feet per square provides for the lap.

Roll roofing and sidings

Roll roofing is made by adding a coating of a viscous, weather-resistant asphalt to a felt that has first been impregnated with a saturant asphalt. Some roll roofings are surfaced with mineral granules to produce a wide range of colors. Some styles are furnished in split rolls, designed to give an edge pattern when applied to the roof. Mineral surfaced rolls may also be embossed to simulate brick or stone for use as sidings.

Shingles

Shingles are all surfaced with mineral granules. There are many weights and patterns of both individual and strip shingles, designed for new roof construction and reroofing. The most popular style is the 3-tab strip shingle. Others include 2- and 3-tab hex strip, individual lock down, individual staple down, and giant individual - American and Dutch lap. These are illustrated in Fig. 1.



3 Tab Square Butt Strip Shingle

2 and 3 Tab Hex Strip

Individual Lock Down

Individual Staple Down

Giant Individual American

Giant Individual Dutch Lap

Fig. 1. A manufacturer may offer this many varieties of shingles in at least 12 different colors.

Unit XIII: What Accessories Do I Need for Asphalt Roofing and Siding?

In addition to the asphalt roofing and siding products previously mentioned, there are a number of accessories that are available for use. These include asphalt coatings and cements, roofing tape, and nails and other fasteners.

Asphalt coatings and cements

Asphalt coatings and cements are asphaltic materials combined with special ingredients and either mixed with suitable solvents or emulsified in water. These materials are processed to various consistencies, depending upon the purpose for which they are to be used.

These materials are flammable and should never be warmed over an open fire, or placed in direct contact with a hot surface. If necessary, they may be softened by placing the container, unopened, in hot water, or by storing in a warm place.

Plastic asphalt cements are processed so that they will not flow at summer temperatures, nor become brittle in low temperatures. They are elastic enough after setting to allow for normal expansion and contraction of the roof deck or movement between the deck and other elements of the structure.

Plastic asphalt cement is used on the flashing points where the roof meets a wall, chimney, vent pipe, or other vertical intersection. It is also used in patching and repairing flashing assemblies. Apply it with a putty knife or caulking gun.

Lap cements are similar to plastic asphalt cements. except not as thick and heavy. They are used to seal the laps with roll roofing. Roofing nails should pass through the cement at the joint so that the shanks of the nails will be sealed where they penetrate the deck material.

Quick setting asphalt adhesive cement is used for sealing down the free tabs of strip shingles and for sealing laps of roll roofing when being applied by the blind-nail method. It has about the same consistency as plastic asphalt cement but is very adhesive and sets quickly.

Roof coatings are of various types and consistencies but are usually thin enough to be applied with a spray or brush. They are used to resurface old asphalt built-up roofs, old roll roofing, or metal that has become rusty or weathered.

Roofing tape

Some manufacturers make a roofing tape of cotton fabric or porous material saturated with asphalt. It is available in widths from 4 to 36 inches and in rolls up to 50 yards in length. It is used with coatings and plastics for flashing, and for patching seams and for breaks and holes in metal and asphalt roofings.

Nails and fasteners

Nails used in applying asphalt roofings are large-headed, sharp pointed, hot galvanized (or equivalent) steel or aluminum nails. They have barbed or otherwise deformed shanks to increase holding power. They are made of 11- or 12-gauge wire, with heads 3/8 to 7/16 inch in diameter.

Nails should be long enough to penetrate through the roofing material and at least 3/4 inch into wood deck lumber. Recommended nail lengths for various conditions are shown in Table 1.

Table 1. Recommended Nail Length

Purpose	Nail Length
Roll roofing on new deck	1 in.
Strip or individual shingles - new deck	1 1/4 in.
Reroofing over old asphalt roofing	1 1/4 to 1 1/2 in.
Reroofing over old wood shingles	1 3/4 in.

To help you in estimating the number of pounds of roofing nails needed, use Table 2.

Table 2. Asphalt Shingle Nails Per Pound

Length	Head	Count
7/8"	7/16"	272
1	7/16"	250
1 1/4	7/16"	202
1 1/2	7/16"	180
1 3/4	7/16"	156
2	7/16"	136
2 1/2	7/16"	112

When deck materials other than wood are used, special fasteners for asphalt roofing products are required. Manufacturer's recommendations should be followed closely in these cases.

Unit XIV: How Much Roofing Will I Need?

Roofing is estimated and sold in squares. To estimate the amount of roofing to buy for any given roof, compute the total area to be covered in square feet, divide this amount by 100, and add for waste and cutting. The amount to add varies with individuals but averages about 10 percent. A simple roof, uncomplicated by dormers or other irregularities, (Fig. 2) will require less, while complicated roofs will require more.

Estimating amount of roofing to buy

The areas of simple surfaces, rectangular in shape, and made up of rectangular elements can be computed easily. The area of a shed roof (Fig. 2a) is the product of eave line times rake line (A times B). The area of the simple gable (Fig. 2b) equals the sum of the rakes, times the eave line (B + C times A). Likewise, the gable roof (Fig. 2c) is estimated by multiplying the sum of the rake lines A, B, C, and D by the eave line E.

It is possible for an estimator to determine the area of a roof without climbing on it, and without going through a long series of complicated calculations. The method requires that: (1) the pitch of the roof be known or determined, and that (2) the horizontal area in square feet covered by the roof be computed.

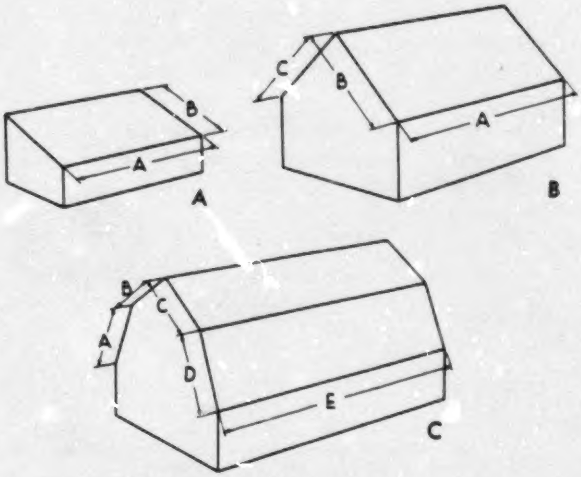


Fig. 2. These simple roofs, (A) shed, (B) gable, and (C) gambrel, are found on many buildings.

Pitch. The span, rise, and run of the simple gable roof are shown in Fig. 3. The pitch or slope of the roof is the relationship between the rise and span. If the span is 24 feet and the rise is 8 feet, the pitch is 8/24 or 1/3. If the rise is 6 feet, then the pitch will be 6/24 or 1/4. The 1/3-pitch roof rises 8 inches per foot of horizontal run and the 1/4-pitch roof rises 6 inches per foot of run. The pitch of a roof is important in determining the kind of roofing to apply.

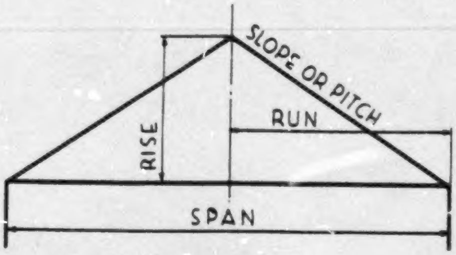


Fig. 3. If the span of a building is 32 feet and the rise is 8 feet, then the pitch is 8/32 or 1/4.

It is possible to determine the pitch of a roof, while standing on the ground, by using a carpenter's folding rule. To do this, form a triangle with the rule. Stand some distance away from the building and, while holding the rule at arm's length, align the roof slopes with the sides of the rule. Be sure that the base of the triangle is held horizontal. The roof of the building will appear within the triangle, as shown in Fig. 4. Be sure the base of the traingle is level or horizontal. Take a reading on the base section of the rule (note the reading point in Fig. 4). Locate the reading point in the top line titled, "Rule Reading" in Fig. 5. Below this point will be found the pitch and rise per foot of run. In the illustration, the reading is 22. Under 22 in Fig. 5, pitch is designated as 1/3, or a rise of 8 inches per foot of horizontal run.

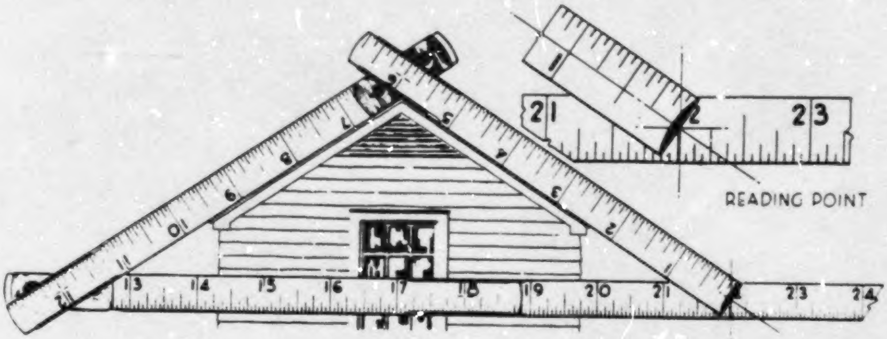
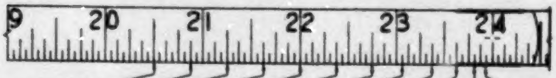


Fig. 4. Use a carpenter's folding rule to determine roof pitch.



RULE READING	20 1/2	20 7/8	21 1/4	21 5/8	22	22 3/8	22 5/8	23 1/16	23 3/8	23 5/8	23 13/16	23 15/16
PITCH FRACTIONS	1/2	11/24	5/12	3/8	1/3	7/24	1/4	5/24	1/6	1/8	1/12	1/24
RISE-INCHES PER FT.	12	11	10	9	8	7	6	5	4	3	2	1

Fig. 5. This table converts reading point to pitch.

Horizontal area. A typical dwelling, having a roof complicated by variable height ridges, is shown in Fig. 6. A projection below the perspective shows the total ground area (horizontal surface) covered by the roof. All measurements needed to draw such a horizontal projection or roof plan can be made from the ground or within the attic space of the house or building. No climbing on the roof is necessary.

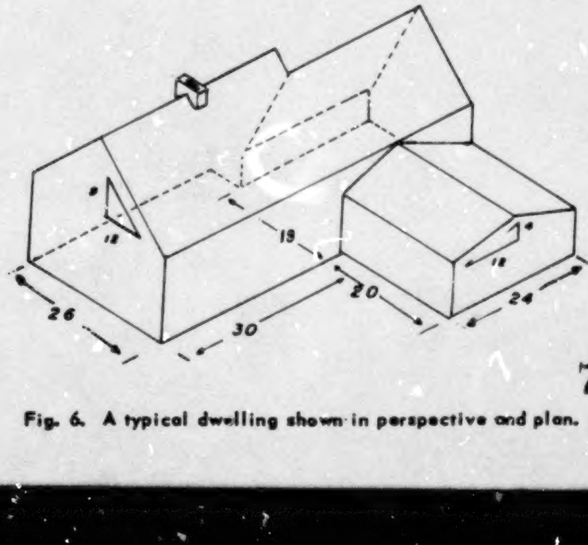


Fig. 6. A typical dwelling shown in perspective and plan.

Roof area. After all measurements have been made and the pitches of the various elements of the roof determined, you are ready to figure the roof area. To convert horizontal areas to slope areas, use the figures in Table 3. First, find the area in the column headed "Horizontal Area" and then find the corrected slope area under the pitch used.

For the building shown in Fig. 6 this would be as follows for the column headed 9 inches.

	Horizontal area	Slope area
	1000	1250
	200	250
	30	37.5
	6	7.5
Total	1236	1545

For the area with a 4-inch rise, it would be:

	Horizontal area	Slope area
	400	421.6
	80	84.3
Total	480	505.9

To check your work, multiply 1236 by 1.25 (conversion factor) = 1545 and 480 by 1.054 (conversion factor) = 505.92. The total area for both pitches will be 1545 + 505.9 = 2050.9. Then, add for wastage. If 10% is added (2050.9 + 205 = 2255), then, 23 squares of roofing should be enough.

Accessories required

The quantity of starter strips, edging strips, valley strips, and ridge shingles to buy depends upon linear measurements along the eaves, rakes, and valleys. Eaves and ridges are horizontal and can easily be measured along the ground or directly from a roof plan. The rakes and valleys run on a slope and must be measured on the roof or figured from appropriate conversion tables.

To determine the length of the rake of the roof without measuring it, first measure the horizontal distance over which it extends. The rake over the ends of the house, shown in Fig. 6, span distances of 26 and 19 feet respectively for a total rake footage of 45 feet. By referring to Table 3 under the 9-inch rise column, you will find the following length of rake for this example.

	Horizontal run	Length of rake
	40	50
	5	6.3
Total	45	56.3

Figure the rake of the ell the same way. Then add these amounts to the total length of the eaves and you have quantity of edging required.

Length of hips and valleys can be determined if the run of the common rafter is known and the information in Table 4, Hip and Valley Table, is used.

The run of a common rafter is one-half the horizontal distance which the roof spans. When used to determine the length of a valley, use the run of a common rafter at the lower end of the valley.

TABLE 3. CONVERSION TABLE

RISE (Inches per ft. of horizontal run.)	1"	2"	3"	4"	5"	6"	7"	8"	9"	10"	11"	12"
PITCH (Fractions)...........	1/24	1/12	1/8	1/6	5/24	1/4	7/24	1/3	3/8	5/12	11/24	1/2
CONVERSION FACTOR	1.004	1.014	1.031	1.054	1.083	1.118	1.157	1.202	1.250	1.302	1.356	1.414
HORIZONTAL (Area in Sq. Ft. or Length in Feet)												
1	1.0	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.4
2	2.0	2.0	2.1	2.1	2.2	2.2	3.2	2.4	2.5	2.6	2.7	2.8
3	3.0	3.0	3.1	3.2	3.2	3.2	3.5	3.6	3.8	3.9	4.1	4.2
4	4.0	4.1	4.1	4.2	4.3	4.5	4.6	4.8	5.0	5.2	5.4	5.7
5	5.0	5.1	5.2	5.3	5.4	5.6	5.8	6.0	6.3	6.5	6.8	7.1
6	6.0	6.1	6.2	6.3	6.5	6.7	6.9	7.2	7.5	7.8	8.1	8.5
7	7.0	7.1	7.2	7.4	7.6	7.8	8.1	8.4	8.8	9.1	9.5	9.9
8	8.0	8.1	8.3	8.4	8.7	8.9	9.3	9.6	10.0	10.4	10.8	11.3
9	9.0	9.1	9.3	9.5	9.7	10.1	10.4	10.8	11.3	11.7	12.2	12.7
10	10.0	10.1	10.3	10.5	10.8	11.2	11.6	12.0	12.5	13.0	13.6	14.1
20	20.1	20.3	20.6	21.1	21.7	22.4	23.1	24.0	25.0	26.0	27.1	28.3
30	30.1	30.4	31.0	31.6	32.5	33.5	34.7	36.1	37.5	39.1	40.7	42.4
40	40.2	40.6	41.2	42.2	43.3	44.7	46.3	48.1	50.0	52.1	54.2	56.6
50	50.2	50.7	51.6	52.7	54.2	55.9	57.8	60.1	62.5	65.1	67.8	70.7
60	60.2	60.8	61.9	63.2	65.0	67.1	69.4	72.1	75.0	78.1	81.4	84.8
70	70.3	71.0	72.2	73.8	75.8	78.3	81.0	84.1	87.5	91.1	94.9	99.0
80	80.3	81.1	82.5	84.3	86.6	89.4	92.6	96.2	100.0	104.2	108.5	113.1
90	90.4	91.3	92.8	94.9	97.5	100.6	104.1	108.2	112.5	117.2	122.0	127.3
100	100.4	101.4	103.1	105.4	108.3	111.8	115.7	120.2	125.0	130.2	135.6	141.4
200	200.8	202.8	206.2	210.8	216.6	223.6	231.4	240.4	250.0	260.4	271.2	262.8
300	301.2	304.2	309.3	316.2	324.9	335.4	347.1	360.6	375.0	390.6	406.8	424.2
400	401.6	405.6	412.4	421.6	433.2	447.2	462.8	480.8	500.0	520.8	542.4	565.6
500	502.0	507.0	515.5	527.0	541.5	559.0	578.5	601.0	625.0	651.0	678.0	707.0
600	602.4	608.4	618.6	632.4	649.8	670.8	694.2	721.2	750.0	781.2	813.6	848.4
700	702.8	709.8	721.7	737.8	758.1	782.6	809.9	841.4	875.0	911.4	949.2	989.8
800	803.2	811.2	824.8	843.2	864.4	894.4	925.6	961.6	1000.0	1041.6	1084.8	1131.2
900	903.6	912.6	927.9	948.6	974.7	1006.2	1041.3	1081.8	1125.0	1171.8	1220.4	1272.6
1000	1004.0	1014.0	1031.0	1054.0	1083.0	1118.0	1157.0	1202.0	1250.0	1302.0	1356.0	1414.0

TABLE 4. HIP AND VALLEY TABLE

RISE { Inches per foot of horizontal run }	4"	5"	6"	7"	8"	9"	10"	11"	12"	14"	16"	18"
PITCH { Degrees	18° 26'	22° 37'	26° 34'	30° 13'	33° 41'	36° 52'	39° 48'	42° 31'	45°	49° 24'	53° 8'	56° 19'
Fractions	1/6	5/24	1/4	7/24	1/3	3/8	5/12	11/24	1/2	7/12	2/3	3/4
CONVERSION FACTOR	1.452	1.474	1.500	1.524	1.564	1.600	1.642	1.684	1.732	1.814	1.944	2.062
HORIZONTAL (Length in Feet)												
1	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.8	1.9	2.1
2	2.6	2.9	3.0	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.9	4.1
3	4.4	4.4	4.5	4.6	4.7	4.8	4.9	5.1	5.2	5.4	5.8	6.2
4	5.8	5.9	6.0	6.1	6.3	6.4	6.6	6.7	6.9	7.3	7.8	8.2
5	7.3	7.4	7.5	7.6	7.8	8.0	8.2	8.4	8.7	9.1	9.7	10.3
6	8.7	8.8	9.0	9.1	9.4	9.6	9.9	10.1	10.4	10.9	11.7	12.4
7	10.2	10.3	10.5	10.7	10.9	11.2	11.5	11.8	12.1	12.7	13.6	14.4
8	11.6	11.8	12.0	12.2	12.5	12.8	13.1	13.5	13.9	14.5	15.6	16.5
9	13.1	13.3	13.5	13.7	14.1	14.4	14.8	15.2	15.6	16.3	17.5	18.6
10	14.5	14.7	15.0	16.2	15.6	16.0	16.4	16.8	17.3	18.1	19.4	20.6
20	29.0	29.5	30.0	30.5	31.3	32.0	32.8	33.7	34.6	36.3	38.9	41.2
30	43.6	44.2	45.0	45.7	46.9	48.0	49.3	50.5	52.0	54.4	58.3	61.9
40	58.1	59.0	60.0	61.0	62.6	64.0	65.7	67.4	69.3	72.6	77.8	82.5
50	72.6	73.7	75.0	76.2	78.2	80.0	82.1	84.2	86.6	90.7	97.2	103.1
60	87.1	88.4	90.0	91.4	93.8	96.0	98.5	101.0	103.9	108.8	116.6	123.7
70	101.6	103.2	105.0	106.7	109.5	112.0	114.9	117.9	121.2	127.0	136.1	144.3
80	116.2	117.9	120.0	121.9	125.1	128.0	131.4	134.7	138.6	145.1	155.5	165.0
90	130.7	132.7	135.0	137.2	140.8	144.0	147.8	151.6	155.9	163.3	175.0	185.6
100	145.2	147.4	150.0	152.4	156.4	160.0	164.2	168.4	173.2	181.4	194.4	206.2

Unit XV: What Type of Asphalt Roofing Material Should I Use?

The wide selection of asphalt roofing materials makes it possible to satisfy almost every roofing requirement. There is no one kind of asphalt roofing that is best for any particular building under all circumstances. Personal preference of the owner and conformity to other buildings in a group are often the determining factors.

Free and effective drainage of rain water from the roof surface is essential if lasting service from the roofing is to be expected. Therefore, it is very important to consider the limitations imposed by the slope of the roof deck when selecting roofing materials.

The steeper the roof slope, the easier it is to prevent leaks. Any kind of asphalt roofing material is suitable on roofs having slopes of 4 inches or more per foot.

Unit XVI: How Should I Prepare the Deck for Roofing?

Much of the success and satisfaction with roofing depends on adequate preparation before roofing materials are applied.

Deck construction and repair

Many roofing troubles are caused by defects in the deck. If the deck is not rigid, loose boards may affect the lay of the roofing. Also poorly seasoned lumber may warp and cause the roofing to wrinkle or buckle.

Wood decks should be made from well seasoned, matched lumber that has been tightly nailed, or from sound plywood of the grade and thickness recommended by the local building codes. Badly warped boards or any containing loose knots should be rejected. Any such defects, discovered after the sheathing is applied, should be covered with sheet metal patches before the roofing is applied.

Proper ventilation of the attic space under the roof deck is also important. This helps prevent the condensation of moisture on the underside of the roof, causing the boards to warp and buckle. It is recommended that one square foot of free opening be provided for each 150 square feet of attic floor space. One half of the area should be distributed in openings located at or near the floor level or in the overhanging eaves, and the other half high in the gable ends or in special protected dormer-type vents in the roof near the ridge. If the ventilation openings are screened against insects, rodents, and birds, the total area of the openings should be doubled.

Plywood decks shall be of the type, grade, and thickness recommended by the American Plywood Association or local building code, whichever is applicable. The design of the eaves, rake, ridge, or any openings through the deck should be such that the plywood will not be exposed to the weather, either on a surface or an edge.

Underlayment (new construction)

All decks, having a pitch of 4 inches per foot or more, should be covered with one layer of No. 15 asphalt saturated felt as an underlayment. Use metal drip edge, made of noncorrodible, nonstaining metal along the eaves and rakes. Nail this to the wood deck at the eaves and over the underlay along the rakes. It is designed to allow water run-off to drip free of underlying construction. It should extend back from the edge of the deck not more than 3 inches. Nail it along its inner edge about every 8 to 10 inches.

After the metal drip edge has been applied to the eaves, lay the No. 15 felt horizontally over the deck, starting at the eaves and working toward the ridge. Lap each course over the lower one at least 2 inches and lap the joints 4 inches. Lap the felt 8 inches from both sides over all hips and ridges.

After the underlayment has been applied, install the metal drip edge on the rakes, covering the underlayment to prevent the wind from blowing rain under the felt.

On decks having a slope between 2 and 4 inches per foot, cover the deck with two layers of No. 15 asphalt saturated felt. Begin the application with a 19-inch starter course laid along the eaves. Follow this with a 36-inch wide sheet, laid even with the eaves and completely overlapping the starter course. From then on, use 36-inch sheets, each overlapping the preceding course by 19 inches, exposing 17 inches of the underlying sheet. Fasten the felt to the deck with only enough fasteners to hold it in place until the shingles are applied.

Eaves flashing

On a normal slope roof, 4 inches per foot or more, use a course of 90-pound mineral surfaced roll fooring or a course of 55-pound smooth roll roofing to overhang the underlay and metal drip edge from 1/4 to 3/8 inch. Be sure it is wide enough to extend up the roof far enough to cover at least 12 inches inside the interior wall line of the building. When the overhang of the eaves requires the flashing to be wider than 36 inches, locate the lap on the portion of the roof deck extending beyond the exterior wall line of the building and cement the lap carefully.

Where severe icing is likely to occur, and on slopes of 2 to 4 inches per foot, apply the eave flashing. Apply a continuous layer of plastic asphalt cement at the rate of two gallons per 100 square feet to the surface of the underlay starter course before the first full course is applied. Apply the cement uniformly with a comb trowel and press the overlying sheet firmly into the cemented area.

Deck treatment for reroofing

If you decide that reroofing is necessary, a choice must be made between removing the old roofing and permitting it to remain. It is generally not necessary to remove old wood or asphalt shingles, or old rolled roofing unless the deck is not strong enough to support the weight of workers and additional new roofing.

If the old roof needs much work on it before you apply a new roof, you might consider applying 3/8-inch plywood over the old roof and then applying the new roof on top of it.

If new asphalt roofing is to be laid over old rolled roofing without removing it, slit all buckles or wrinkles and nail the segments down smoothly. Remove all loose or protruding nails.

Examine the shingles and trim at the eaves and rake edges carefully. If these shingles are badly weathered and the building is exposed to high winds, remove the shingles at the eaves and rake edges far enough back to allow the application of 1 x 4- or 1 x 6-inch wood strips. These should project beyond the edges of the deck the same distance as the old shingles that were removed.

Unit XVII: How Should Strip Shingles be Applied?

With new construction, have the deck properly prepared before starting to apply strip shingles. The preparation of the roof for reroofing has already been explained.

Before any shingles are applied, apply a layer of No. 15 asphalt saturated felt over the entire deck. Start laying strip shingles from either rake, but on roofs 30 ft. or longer, it is better to start them at the center and work both ways. This will insure more accurate vertical alignment and provide for meeting and matching above any projection through the roof, such as a dormer or chimney.

Asphalt shingles have minor variations in the dimensions. These variations will seldom exceed 1/4-inch in a 12 x 36-inch shingle. To control the proper placement of shingles, so that the cutouts will be accurately aligned horizontally, vertically, and diagonally on the roof, it is essential that you use chalk lines as a means of controlling alignment.

Square-tab strip shingles are recommended for use on decks having a slope lower than 4 inches per foot but not less than 2 inches per foot. Special application methods are used to compensate for the slower water runoff that results from the lower roof slope. These special application methods include first, double underlayment; second, a special cemented eave flashing strip; and third, using shingles with factory applied adhesive.

Starter course

Apply a 9-inch strip of mineral surfaced roll roofing of a color to match the shingles or a row of inverted shingles to make the starter course. Apply this along the eave to overlay the eave flashing strip and to be even with the lower edge. Fasten it with roofing nails, located in a line parallel to and 3- to 4-inches above the edge. Place the nails so the heads will not be exposed at the cutouts of the first course.

When using inverted shingles, apply them with the tabs facing up the roof and their edges even with the lower edge of the eave flashing strip. This method is preferred for hex-type strip shingles to insure a satisfactory color match, at the space between tabs along the eaves. Place nails so they will not be exposed at the cutouts of the first course.

Start the first course with a full shingle and succeeding courses with full or cut strips, depending upon the style of shingles being applied and the pattern desired. There are three major variations for square-butt shingles. These variations are to break joints on thirds, halves, or random spacing.

When breaking joints on thirds, start the second course with a strip which has had 4 inches cut off the end, and the third course with 8 inches cut off. The fourth course will then have the entire first tab cut off. This will cause the cutouts to break joints on thirds with the courses below. Courses 5, 6, and 7 repeat the process or continue by removing 1 1/3 tabs, 1 2/3 tabs, and 2 tabs respectively, from each first strip before applying it to the rake.

When it is desired that the cutouts are centered, start the second course with a strip from which 6 inches has been removed, and the fourth strip with half of the strip removed. This causes the cutouts to be centered on the tabs of the course below.

Random spacing can be achieved by removing different amounts of the rake tab of succeeding courses in accordance with certain principles. First, the width of any rake tab should be at least three inches. Second, the cutout center lines of any course should be located at least three inches laterally from the cutout center in both the course above and the course below it. Third, rake tab widths should not repeat closely enough to cause the eye to follow a cutout alignment. For random spacing, start the first course with a full-length strip. This indicates the length of the starting tab of each succeeding course necessary to produce a satisfactory spacing.

Wind protection

For protection against high winds, it is desirable to use shingles with factory applied adhesive.

If free-tab shingles are used, an effective way to obtain protection against high winds is to cement the free tabs. Apply a spot of quick setting cement about the size of a 50-cent piece on the underlying shingle with a putty knife or caulking gun, and press the free tab down against the spot of cement but not hard enough to squeeze the cement out from under the edge of the tab. Do not skip or miss any tabs that tend to blow up and do not bend them back any farther than necessary.

Nailing. Where strong winds are to be expected, nailing requires extra care. Greater anchorage of the shingles to the deck can be obtained by using six nails per strip. Then, they should be placed 5/8 inch above the top of the cutouts and located horizontally so there will be one nail an inch back from each end of the strip and one nail 1 1/2 inches on each side of the cutout center line.

Two and three tab hex shingles

Some manufacturers have discontinued hex shingles and others have them available only in limited colors. It may still be desirable to know how to apply these if it is necessary to match the roof when an addition is built to a building.

Both the two and three-tab hex strip shingles require four nails per strip. Locate them in a line 5 1/4 inches above the exposed butt edge and located horizontally. Apply each course so that the outer edges of the tabs are aligned with the top of the cutouts of the preceding course.

Use hip and ridge shingles, or cut individual shingles from 12 x 36 square butt shingles, or from mineral surfaced rolled roofing of a color to match the shingles. They should be at least 9 x 12 inches.

Flashings

All roofs are not as simple as those shown in Fig. 2. Roofs are often complicated by an intersection or other roofs, adjoining walls, or projections through the deck, such as chimneys and soil stacks. These complications create opportunities for leakage, and special provisions need to be made for turning the weather at these points. The construction used under these conditions is commonly called "flashing." Pay careful attention to flashing to assure good roof performance regardless of the type of construction or the additional time and cost necessary to do a good job.

Flashing against a vertical wall

New construction. When the rake of the roof abutts a vertical wall, the most satisfactory method of protecting the joint is to use metal "flashing shingles" applied over the end of each course of shingles. This is sometimes called "step flashing."

The flashing shingles are rectangular in shape, from 5 to 6 inches long and 2 inches wider than the exposed face of the roofing shingles. When used with strip shingles laid 5 inches to the weather, they are 6 x 7 inches. They are bent so as to extend 2 inches out over the roof deck and the remainder up the wall surface. Place each flashing shingle just up-roof from the exposed edge of the shingle which overlaps it and secure it to the wall sheathing with one nail in the top corner. As the metal is 7 inches wide and the roof shingles are laid 5 inches to the weather each flashing shingle will lap the next by 2 inches. Bring the finished siding down over the flashing to serve as cap flashing, but far enough away from the shingle that the board may be readily painted to exclude dampness and prevent rot.

Reroofing. When applying new asphalt shingles over an old roof, the joint between the vertical wall and the adjoining roof is treated differently. Level the old shingles and apply a strip of smooth roll roofing 6 to 8 inches wide over the shingles abutting the wall surface. Use a row of nails along each edge. Place the nails approximately on centers. As the roofing is applied, cover this strip with asphalt plastic cement and bed the end of each course of new shingles firmly into the cement.

You can sometimes improve the appearance and make a tighter joint by using a caulking gun to apply a bead of asphalt plastic cement between the ends of the shingles and the sides.

Chimneys

Chimneys are usually built on their own foundations to avoid stress and distortions to the building due to uneven settling. For this reason, chimneys are normally subject to some differential settling from the building. Flashing at the point where the chimney projects through the roof calls for construction which will allow for such movement without damage to the water seal. It is necessary to use base flashings which are secured to the roof deck and counter or cap flashings which are secured to the masonry.

Before placing any flashings, apply shingles over the roofing felt up to the face of the chimney and construct a cricket or saddle, between the back face of the chimney and the roof deck. The purpose of the cricket is to prevent the accumulation of snow and ice and to deflect the down flowing drainage water around the chimney. This is an important element in construction.

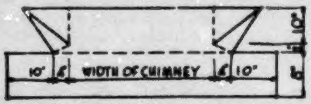
Apply a coat of asphalt primer to the brick work to seal the surface at all points where plastic cement will later be applied.

Cut the base flashing for the front according to pattern A and apply this flashing first. Lay the lower section over the shingles in a bed of plastic cement and secure the upper vertical section against the masonry with plastic cement and nails driven into the masonry. Bend the triangular ends of the upper section around the corners of the chimney and cement them in place.

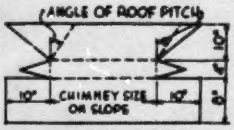
Make cap flashings of 16-oz. sheet copper or 24-gauge galvanized steel painted on both sides. Secure cap flashings to brick work.

An alternate method of base flashing is known as "step flashing." It consists of placing a rectangular piece of flashing 8 x 22 inches over the end tab of each course of shingles, holding the lower edge slightly back of the exposed edge of the covering shingle, bending it up against the masonry, and securing it with suitable asphalt cement.

Nail through the lower edge of the flashing into the roof deck and cover the heads with plastic cement. Repeat this operation for each course. Be sure flashing units are wide enough to lap each other at least 3 inches and that upper one laps the lower one each time. When roofing is used for step flashing, it replaces the base flashing but metal cap flashing must also be applied in the usual manner for a satisfactory job.



PATTERN 'A'



PATTERN 'B'

Soil stacks

Practically all dwellings, and some industrial and farm buildings, have pipes or ventilators projecting through the roof which require special flashing.

Cut and fit the shingle or roll roofing around the pipe. Then before applying the roofing, prepare a flashing flange as follows:

1. Cut rectangular flange from 55 lb. or heavier roll roofing, which is large enough to extend 4 inches below the pipe, 8 inches above, and 6 inches on each side of the pipe when it is installed. It should preferably be in one piece, but if this is not possible, the total length of the material should provide for at least a two-inch lap where horizontal joints may occur.

2. Mark a line, 4 inches above and parallel to the lower edge, and lay the material on the roof adjacent to the pipe so that this line will be even with the down-roof side of the pipe. Then draw another line parallel to the first and even with the up-roof side of the pipe.

3. Now lay the flange on the roof below the pipe and align its center with the center of the pipe. Draw two more parallel lines at right angles to the first pair, even with the sides of the pipe. The resulting oblong marks the exact position or location of the opening. Then, sketch the oval freehand with sufficient accuracy for the purpose and cut it out.

4. Then, slip the flange over the pipe and lay it flat on the roof. Form a collar of plastic cement around the pipe and up it about 2 inches and out over the flange about 2 inches. Be sure the cement is vigorously and thoroughly troweled into place, so that it will adhere properly and that all air pockets have been eliminated.

After the flashing is applied, continue shingling up the roof. Be sure the flange overlaps the shingles on the lower side of the pipe, but is covered with shingles at the sides and above the pipe. Fit the shingles around the pipe and bed them in asphalt plastic cement where they overlay the flange. It is important to avoid driving any nails close to the pipe.

Flash ventilators and exhaust stacks, that are located at the ridge, in essentially the same manner, except you bend the flange over both sides of the ridge and lap the roof shingles at all points. Install hip shingles to cover the flashing and bed them in plastic cement where they meet the pipe.

When reroofing, examine the old metal flashing around the pipe carefully. If it is deteriorated, remove it and apply new flashing as explained above. If the metal flashing is in good condition, lift the lower part of the flange and apply new shingles underneath it up to the pipe. Then, replace the flange, bed it in plastic cement, and protect the junction of the metal sleeve and the flange with an application of plastic cement. Continue to apply shingles around the pipe and up the roof.

It is frequently possible to obtain non-corrodable metal pipe equipped with adjustable flanges. These can be applied as flashing and adjusted to fit any pitch roof. Recently a neoprene flashing has been introduced that can be stretched to fit over the soil stack.

Valleys

Valleys exist where two sloping roofs join at an angle, causing runoff toward and along the joint. Because drainage concentrates at the joint, it is especially vulnerable to leakage. To prevent leaking, provide a smooth, unobstructed drainageway that has enough capacity to carry the water away rapidly.

Two types of valley treatment are the open valley and the closed or woven valley. Prepare the valley by applying a saturated felt underlayment. This is a 36-inch wide strip of No. 15 asphalt saturated felt, centered in the valley and secured with only enough nails to hold it in place until the shingles are applied. Cut the courses of felt underlay that are applied to the roof so they overlap the valley strip by at least 6 inches. After this apply the flashing strip.

Open valleys. Mineral surfaced roll roofing of a color to match or to contrast with the roof covering is satisfactory for valley flashings. Center an 18-inch wide layer of the roofing in the valley, with the surface side down. Cut the lower edge to conform with and be flush with the flashing strip. If it is necessary to splice the material, overlap the ends of the upper segments over the lower segments and secure them with asphalt plastic cement. Use only enough nails to hold the strip smoothly in place. Nail the strips only at each edge. Press the roofing firmly in place into the valley as you proceed with the nailing along the second side. Place a strip 36 inches wide on top of the first strip. The 36-inch strip should have a mineral surfaced side up and be centered in the valley and secured with nails in the same manner as the 18-inch strip.

Before the roofing is applied, snap two chalk lines the full length of the valley. Put one on each side so that they will be six inches apart at the ridge (3 inches measured from the center of the valley along each of the intersecting roofs) and will widen at the rate of 1/8 inch per foot as they approach the eave.

(For example, a valley 16 feet long will be 6 inches wide at the ridge and 8 inches wide at the eave.) When a course of shingles or roll roofing is brought to the valley, the chalk line serves as a guide in trimming the last unit to fit. This insures a clean, sharp edge. Clip the upper corner of each end shingle. To prevent water from penetrating between the courses, cement the roofing material to the valley lining with a suitable asphalt cement.

Closed or woven valley. This method of covering valleys is preferred by some but its use is limited to strip-type shingles. Individual shingles cannot be used because nails might be required at or near the center of the valley lining. This method has the advantage of doubling the coverage of shingles throughout the length of the valley and adds to the weather resistance of the roof at the point which might otherwise be most likely to cause leakage.

The first step in constructing the valley is to center a 36-inch wide strip of 50 pound or heavier roll roofing in the valley over the underlayment. Then, lay valley shingles over the lining, either by applying them on both roofs at the same time, and weaving each course in turn over the valley, or cover each roof first to a point approximately 3 feet from the center of the valley and weaving the valley in place later.

When following the first procedure, lay the first course along the eaves of one roof up to and over the valley, extending it along the adjoining roof deck for a distance of at least 12 inches. Then, lay the first course along the eaves of the adjoining roof, and over the valley on top of the previously applied shingle. Succeeding courses are then laid alternately, first along the roof deck, then along the other, weaving the valley shingles over each other. When following the second procedure, weave the valley shingles in the same way.

Make sure that the shingles are pressed tightly into the valley and then apply nails in the normal manner, except be sure that no nail is located closer than 6 inches to the valley center line. Apply two nails at the end of each terminal strip. In order to avoid placing a nail too close to the center of the valley, it may be necessary to occasionally cut a strip short that would otherwise end near the center, and continue from this cut end over the valley with a full length strip shingle. When reroofing, it is recommended that the old valley be built up with a wood strip to the average level of the roofing.

Unit XVIII: How Should I Lay Individual Shingles?

Individual hex shingles

Individual hex shingles are of two types: those that are secured at the lower corners by a staple and those that are designed with a locking device. Both types are relatively lightweight units and are primarily used for reroofing over old roofing. These shingles should be used on decks having a rise of 4 inches or more per foot.

Lock-type shingles

Lay a starter course of shingles which has had the portion below the shoulder corners cut off. When the center starting method is used, center the first unit between the rakes and lay the others both ways toward the rakes. Trim the end shingles off even with the rake ends of the eave flashing strips. Place all units so that their cut edges are flush with the overhanging edge of the eaves. Place two nails evenly along the lower cut edge.

Use shingles that have had the locking tabs cut off for the first course. Lay the lower cut edge of each shingle flush with the bottom of the eave flashing strip and center it over the shoulders of the starter course shingles.

Apply second and succeeding courses in the same manner. Secure the lower corner by inserting the locking device as specified by the manufacturer. Apply hip and ridge shingles as described for hexagon shingles.

In areas where high winds may be expected, apply a strip of special asphalt cement along the eaves and rakes to extend back from the edges of the deck approximately 6 inches. Imbed the eave and rake shingles in it. Secure them with nails as specified before.

Giant individual shingles

Giant individual shingles are applied by two methods; the Dutch lap method and the American method.

The Dutch-lap method results in a single coverage roof and is intended primarily for reroofing over old roofings. This method may be used over any type of old roofing that provides a relatively smooth surface. They should not be applied on decks having a rise of less than 4 inches per foot. They may be applied over new decking provided an adequate underlayment is provided.

The American method may be used for new work or for reroofing. If the shingles are applied as new work, apply an adequate underlay of No. 15 asphalt saturated felt, and a metal drip edge and eave flashing strip. Lay all shingles, except those in the starter course, with the long dimension parallel to the rake and exposed 5 inches to the weather. Snap horizontal and vertical chalk lines to insure good alignment.

Lay the starter course even with the lower edge of the eave flashing strip, with shingles placed horizontally and in contact with each other. Fasten each shingle with three nails. Use full shingles on the first course and lay them with the long dimension vertical. Place this row of shingles flush with the eave and rake edges of the starter course, and space them a maximum of 3/4 inches apart. Secure each shingle with two nails.

Begin the second course with an 8-inch wide shingle and continue with full shingles spaced 3/4 inches apart. Begin the third course with a 4-inch wide shingle and the fourth course with a full shingle, repeating the sequence to the ridge. Complete each course with full shingles spaced a maximum 3/4 inches apart. This will break the joints on thirds. If it is desired to break joints on halves, begin the second course at the rake with a 6-inch wide shingle and the third course again with a full shingle.

Where high winds may be expected, place a one square inch spot of quick setting cement, of the type recommended by the manufacturer, under the exposed portion of the shingle. Press the shingle firmly in the cement, but not hard enough to cause the cement to squeeze out over the exposed surface. Do not bend the shingle any more than necessary to place the cement and also take special care when bending the shingles over hips and ridges. Bend them lengthwise along the center line so as to have a six-inch exposure on each side.

Unit XIX: How Should Interlocking Shingles Be Applied?

Lock-down or interlocking shingles are designed to withstand strong winds. They are made with locking devices which vary in detail. The locking device holds the shingle down without the use of adhesives. Cement may occasionally be necessary along rakes and eaves where the locking device has been removed.

Lock-type shingles can be used for both new construction and reroofing over old materials. Correct nailing is essential with this type of shingles and the manufacturer's recommendations should be followed precisely.

Deck preparation, underlayment, metal drip edge, eave flashing, and other preparations should be made in accordance with the recommendations for the pitch of the roof.

Lock-type shingles are self-aligning, but are sufficiently flexible to allow for a limited amount of adjustment. Be sure to engage the locking devices carefully and correctly. Some styles of lock-type shingles require the removal of part or all of the locking device along eaves and rakes. Because these shingles are interlocked with adjacent shingles, wind pressures are transmitted from shingle to shingle. To prevent wind damage starting at the edges, such modified rake and eave shingles should either be cemented or face nailed.

Unit XX: How Is Roll Roofing Applied?

Roll roofing is available in different mineral surfaced colors and in different shapes and designs. It may be applied with exposed nails, concealed nails, or double coverage.

It is not a good practice to apply roll roofing when the temperature is below 45°. When it is absolutely necessary to handle the material below this temperature limit, warm it before unrolling to avoid cracking. Cut the roofing in 12-to 18-ft. lengths, and spread them on a smooth surface until they flatten out. If maximum life and service are important considerations, use the concealed nail method rather than exposed nails.

Use only the lap cement or quick setting cement supplied by the manufacturer. Store the cement in a warm place until it is ready for use. If it is necessary to warm the cement, follow the safety suggestions made earlier.

If the construction supporting the roof is such that there is unlikely to be puddles of water standing after a rain, the following minimum roof pitches are safe for the type of application indicated.

1. Exposed nail method - two-inch lap. Acceptable minimum pitch 2 inches per foot.

2. Concealed nail method - three-inch lap. Acceptable minimum pitch one inch per foot.

3. Concealed nail method (double coverage). Acceptable minimum pitch one inch per foot.

Exposed nails

Parallel to eaves. Use a full width sheet for the first course. Start it so the lower edge and the end will extend over the eave and rake from 1/4 to 3/8 of an inch. Nail along a line from 1/2 to 3/4 inch down from the top edge every 18 inches to secure it while the second course is being placed. Nail along the eave and rake on a line approximately one inch from the edge of the roofing. The nails should be placed two inches on center and slightly staggered along the eave.

Apply the second course so that it will lap the first course two inches and nail it along the top edge with nails spaced approximately 18 inches apart. Lift the lower edge of the overlapping sheet in the cement and nail through the lap on two-inch centers. Stagger the nails slightly and place them at least 3/4 inch up on the exposed sheet. Continue applying similar courses up the roof, and the last sheet even with the ridge.

Parallel to rake. Start at one end of the ridge and use strips that have been cut to allow the lower end to project 1/4 to 3/8-inch over the eave. Place the first strip so that it overhangs the rake the same amount. Apply the second course as explained for roofing applied parallel to eaves and nail and cement it in the same manner.

Patterned edge roll roofing. The exposed nail method may also be used for pattern-edged roofing. This material is recommended for reroofing over old roofing on decks having a slope of 4 inches per foot or greater. It must always be applied parallel to the eaves. Lay the first course reversed with the pattern edge up-roof. The straight edge should overhang the eave as mentioned above. Succeeding courses then lap each other and are secured with a nail centered at each lap and cutout. The minimum top lap is 2 inches.

Make all end laps 6 inches wide and cement the full width of the lap. Stagger the nails in rows one inch and five inches respectively from the end of the lap. Space the nails on four-inch centers in each row. Stagger all end laps so no end laps will be over or adjacent to an end lap in the preceding course.

Butt the sheets of roofing together and nail them as they come up on either side of a hip or ridge. Cut strips of roll roofing 12 inches wide and bend them lengthwise through the centers to apply to the hips and ridges. Snap a chalk line parallel to the hip or ridge about 5 1/2 inches down on each side. Spread a 2-inch wide band of cement on each side of the hip or ridge so that its lower edge is even with the chalk line. Center 12-inch strips of roofing on the hip or ridge and embed the edges in the cement. Secure the strip in place with nails 3/4 inch above the edge of the strip with the nails spaced 2 inches on center. It is important that the nails penetrate the cemented portion in order to seal the nail holes.

Concealed nails

Parallel to eaves. Place 9-inch strips of roofing along eaves and rakes to overhang the edge of the deck 1/4 to 3/8 inches. Secure them with two rows of nails, one inch from each edge. Place the nails 4 inches apart in rows.

Apply a full width of roofing so that its rake and eave edges will be flush with the outer edge of the edge strips. Before the edge strip is covered with cement, secure the upper edge of the first course with a row of nails spaced 4 inches apart. The next course should overlap the nails by at least one inch. Apply the recommended cement and press the lower edge and rake ends of the sheet firmly in place over the edge strips.

Apply the second and succeeding courses to overlap each preceding course by the predetermined lap. Secure them along the upper edge with nails located in the same manner as described for the first course. Do not apply nails within 18 inches of the rake edges until cement has been applied to the edge strip. Press the overlying sheet firmly into the cement before nailing.

Lift the lower edge of each course and apply the cement in a continuous layer over the full width of the lap. Press the lower edge of the upper course firmly into the cement so that a small bead appears along the edge of the sheet. Apply the pressure uniformly over the entire cemented area.

Parallel to the rake. In general, the recommendations for horizontal application apply to vertical application, except that the sheets are started from the ridge where they are fastened (3 or 4 nails) and unrolled toward the eaves. Sheets should be permitted to hang freely on the roof until they lie smoothly before they are nailed and the laps cemented.

Make end laps 6 inches wide and cement the full width of the lap with the recommended cement. Apply nails only to the underlying sheet in two rows in the same way as described for exposed nail application.

Finish the hips and ridges. Use strips of roofing 12 x 36 inches for hip and ridge covering. Apply these, starting at the lower end of the hip or at either end of the ridge and "shingle" the pieces in place. Lap each one 6 inches over the preceding one. The best method is to follow these steps: (1) Snap a chalk line on each side of the hip or ridge 5 1/2 inches away from the peak. (2) Apply cement from one line over the peak to the other. (3) Fit the first folded strip of roofing over the hip or ridge and press it firmly into the cement, nailing only on the end which is to be covered by the overlapping piece. (4) As the work progresses, spread cement over the entire portion of each strip, which is to be lapped before the next one is applied. (5) Press the overlapping end of the succeeding strip firmly into the cement and repeat the process to the end of the hip or ridge.

Pattern edge. The correct procedure for applying pattern-edge roofing with concealed nails is similar to roll roofing. Lay the roofing as explained for exposed nails, except all nails should be along the top of the sheet and staggered about four inches apart and no nail more than 2 inches below the top of the sheet. Apply the cement and press the lower edge of the rake end firmly in place over the edge strip. Do not apply nails within 18 inches of the rake until after the cement is in place and the sheet pressed down.

Finish the hips and ridges. Cut units of pattern edge roofing across the sheet at the center of each cutout for hip and ridge finish. Lap each one by at least one-third length of the overlying unit. Use cement on the entire lapped area.

Double coverage

Nineteen-inch selvage double coverage roll roofing is produced in a 36-inch wide sheet with 17 inches mineral surface and 19 inches unsurfaced. The selvage, unsurfaced portion is variously finished by different manufacturers. Some of these may be applied with cold asphalt adhesives, others with hot asphalt only, and still others with either one. It is important to know the type of product being used in each instance and to follow the manufacturer's directions. This roofing may be used on decks having a rise of 1 inch or more per foot of horizontal run.

Any roll roofing may be applied as double coverage. Make the lapped portion of the sheet 2 inches wider than the exposed portion to insure that there is complete double coverage and that the seams are lapped.

Starter strip. Cut the 19-inch selvage portion from the strip of roofing and apply it parallel to the eaves so it projects beyond the edge of the metal strip at both eave and rake 1/4 to 3/8 inch. Secure it to the deck with three rows of nails. Place the top row of nails 4 1/2 inches below the upper edge of the sheet, the lower row 1 inch above the lower edge of the deck, and the third row half-way between. Drive the nails in the upper and middle rows about 12 inches apart, slightly staggered.

Apply the first row of roofing with the end of the lower edge flush with the rake and eave edges of the starter strip. Secure it with two rows of nails in the selvage portion. Place the first row 4 3/4 inches below the upper edge and the second row 8 1/2 inches below the first. Drive the nails 12 inches apart in the rows. Lap the previous courses each time the full 19 inches as succeeding courses are applied.

Lift the mineral surfaced exposed part of the sheet and apply cement to the entire surface of the selvage portion of the underlying sheet. Apply the cement to within 1/4 inch of the edge of the exposed portion and press the overlying sheet firmly into the cement. Apply pressure over the entire cemented area, using a broom or light roller to insure complete adhesion between the sheets at all points. Spread the cement in such a manner that when pressure is applied to the overlying sheet, the cement is brought all the way to the edge of the surfaced section.

End laps. Make all end laps at least six inches wide. Secure the underlaying mineral surfaced portion of the lap to the deck with a row of roofing nails located one inch back from the end of the normally exposed part and spaced four inches apart in the row. Spread asphalt cement evenly over 5 1/2 inches of the 6-inch lap area. Bring the overlying sheet down and press it firmly into the cement. Secure the overlying sheet of the deck back from the end of the selvage portion of the sheet on four-inch centers. Stagger all end laps so no end lap is adjacent to one in a preceding course.

The specifications for horizontal application also apply to vertical application, when the roofing is applied parallel to the rake edges. Locate the first sheet so it overhangs the rake instead of the eave and make all end laps so that the up-roof sheet overlies the lower one.

Unit XXI: Applying Asphalt Siding

Asphalt siding materials are in two forms, as roll products and as shingles. Roll materials are mineral surfaced, and embossed to simulate either brick or stone. Shingles may be either strip type or individual.

Asphalt sidings may be applied on new wall surfaces, or over old materials when remodeling or improving the appearances of buildings. Be sure the exterior walls, to which asphalt materials are to be applied, are solid, plumb, and smooth. Old walls should be rehabilitated to provide such a surface. The base to which the siding is to be applied should have good nail holding power.

Roll brick siding

The general recommendation for handling roll roofing should also be followed with roll siding. Both the material and the surface to which it is applied should be dry. Use non-corrodable nails, with checkered or smooth heads, that are long enough to penetrate 3/4 inch into the wall surface to which the material is to be applied. Nails should be colored to match the siding material through which they are driven. This usually calls for black headed nails at the mortar joints and other appropriate colors for base nailing.

Snap a horizontal chalk line around the building at a distance above the lowest point of the prepared wall surface. Make the chalk line a one-quarter inch less than the width of the siding material. Use additional horizontal and vertical chalk lines to assure proper alignment of the courses. Where the building is badly out of line, other adjustments may be required at corners and openings.

Set the first course even with the first horizontal chalk line. Secure it with sufficient nails along the selvage edge to hold it in place and then face nail it with appropriately colored nails.

Place second and succeeding courses so that the top of the strip is even with the horizontal chalk line, and so that it will lap the course next below by the amount of selvage edge less the width of one mortar joint.

Cut adjoining edges of meeting strips at right angles to the strip. Cut them at a point that will insure the preservation of the prescribed pattern. Place a strip of No. 15 asphalt saturated felt 6 inches wide and as long as the height of the course behind the joint so that it overlaps the selvage edge of the lower course. Imbed the joining edges in suitable asphalt cement that is applied to the flashing strip before nailing the course down.

Locate the nails for horizontal lap edges one-half inch above the lower edge of the overlying course. Space them approximately four inches apart. At vertical joints, such as inside corners, windows, doors, and other openings, locate the nails in a line 1/2 inch from the cut edge of the strip and space them 2 inches apart. Place a nail in the center of each vertical mortar joint throughout the side. Avoid driving the nails too tightly. Tight nailing has a tendency to create an uneven or quilted effect.

Cut a 12-inch wide flashing strip of No. 15 asphalt saturated felt and fasten it in the inside corners. The strip should be long enough to overlap the selvage edge of the underlying course. Bend it into the angle at each course. Cut the siding strips to fit snugly into the corner and apply asphalt cement to the flashing strip before nailing.

Where the wood trim around windows, doors, and other openings protrude beyond the face of the wall surface, cut the siding to fit around the edge of the trim and under the window sill. Imbed the siding in a narrow bead of asphalt cement before nailing.

Where the wood trim around the openings is flush with the old siding or the underlying backup board, apply a narrow wood molding or a special metal stop manufactured for the purpose. Apply this one inch from its edge and butt the siding snugly against it. Imbed the siding in a narrow bead of asphalt cement before nailing.

Individual siding shingles. Secure each shingle with three nails, one concealed and two exposed. Locate the concealed nail in the center of the shingle one-half inch from the top edge. Place an exposed nail in each lower corner, 1 inch from the side and 1 1/2 inches above the lower edge. Use either non-corrodable nails with checkered heads or common galvanized roofing nails for concealed locations, and nails with heads colored to match the shingles for the exposed ones. All nails should penetrate the wall surface at least 3/4 inch.

Snap a horizontal chalk line around the building at a height above the lowest point in the old siding or backing equal to the length of a shingle less one fourth inch. This will insure that the shingle will extend at least 1/4 inch below the bottom edge of the prepared wall surface.

The starter course, consists of shingles placed at intervals which will provide for a side lap by the overlying first course of not less than 2 inches. For 12-inch wide shingles, space them 8 inches apart. Secure each shingle with nails located 1 inch in from each side and 3 to 4 inches above the lower edge of the shingle.

Center the shingles of the first course over the spaces between the shingles in the starter course. Secure each shingle with one concealed nail and two exposed nails. Also center the shingles of the second and succeeding courses over the spaces between the shingles in the course below. Outside corners may be treated in several ways: (1) Use metal corner beads manufactured for the purpose. (2) Use wood corner boards against which end shingles are placed and caulked. (3) Place shingles around the corner in the same manner as specified for hip and ridge shingles on the roof. (4) If the corners are not plumb or square, the siding shingles may need to be adjusted during application to compensate for any irregularities in order to improve the appearance of the job.

Center a 12-inch wide flashing strip of No. 30 asphalt saturated felt in each inside corner. Cut the shingles to fit snugly in the corner and secure them with nails as specified.

If the trim projects beyond the face of the prepared wall surface, cut the shingle to fit snugly against the edge of the trim and under the window sills. At the joint between the shingle and the trim, imbed the shingles in suitable asphalt cement or caulking compound.

Place the shingles up to the top of the wall and imbed the top edge of the last course in asphalt cement. Make sure that the top edge of the upper-most course is protected from direct exposure to the weather. Use a wood molding if necessary to do this.

Unit XXII: What is the Wind Hazard to Roofing?

Some sections of the country are more subject to wind than others. Those, however, that are often considered free from damaging winds, occasionally have wind losses. The greatest wind hazard is usually in the outlying areas. Some homeowners wish to live in exposed remote areas while farm buildings have always been located where they are exposed to greater wind than those located at center of towns. Often times the construction in an open area is the same type of construction as in the most sheltered area in the center of town. When builders realize that construction in open areas are outside the jurisdiction of building codes, they are less careful in their construction. Roof construction would be simple if we could be assured that the wind will blow from only one direction at a constant speed never exceeding 60 or 70 mph.

The wind blows from different directions and is anything but steady. When the wind gets up to 35 mph, it blows in gusts. It may be 35 mph one minute then drop off to 5 mph, then rise to 45 or 50 mph. It is the hammer-like blows with which it strikes a roof that gradually weakens it. Experts feel that very rarely does a single gust of wind take the roof off of a building structure. Roof damage occurs in stages. The first blast may lift the roof slightly and then replace it in its original position. The next gust lifts it a little higher, etc.

As far as value is concerned, the cost of a roof is a minor part of the building but it is the protective skin, which, when blown off or torn, admits rain that always seems to accompany high winds. Rain causes extremely heavy damage to contents of buildings and may result in considerable loss.

The surface of a roof is effected by the same wind forces as the roof structure itself. The fact that the surface is fastened only by adhesive material or nails is one of the main reasons why it may be lifted off. If the roof structure extends beyond the walls and the roofing material is lapped over the edge of the decking and tacked in place, wind quite easily works its way under the roofing material. With age, the roofing felt becomes brittle and the adhesives weak.

Constant maintenance is necessary to maintain a good roof. A small leak exposes the roof decking to the weather and rotting sets in weakening the deck and the adhesive.

Roll composition roofing that is nailed along the edges and not fastened by an adhesive is especially subject to wind damage. The wind gets under the areas between the nails and easily tears the material and rolls it back. When it is cemented on, the danger is greatly reduced but the cementing should cover the entire area and not just part of it.

There is competition in the roofing business, as in any other business, and if a roofer can use a shorter nail than his competitor and save a few dollars, he may get the contract. It is not uncommon to find nails that are too short, insufficient number of nails, lack of underlayment, and other shortcuts being applied to increase the profit for the unscrupulous roofer.

Leadership

Instructor's Guide:

1. This unit is provided as an option unit to the "Securing a Job" unit or any other leadership unit.

Objectives:

1. List four (4) leadership functions.
2. Organize and list leadership activities.
3. Identify six (6) positive leadership characteristics.
4. Describe the importance of a goal.
5. Develop personal goals.
6. Develop an Action Plan for reaching short and long term goals.
7. Distinguish between management and labor.
8. Identify and list the steps in the Decision Making Process.
9. List the four steps involved in Personnel Management.
10. List and describe ten (10) characteristics of a Productive Leader.

Teaching Aids:

1. Leadership and Personal Development Series: FFA Supply Service.

References:

1. Leadership and Personal Development: FFA Supply Service.

Introduction Ideas:

1. Invite respected leaders in the community to serve as guest speakers on the topic of leadership.
2. Utilize a Senator or Representative from the local area as a quest speaker on the topic of leadership.

Leadership

I. Introduction

A. At the time of George Washington we had many outstanding leaders.

1. Thomas Jefferson.
2. Ben Franklin.
3. Many other signers of the Declaration of Independence.

B. If just taking George Washington and population then of 250,000 and comparing to our present population as a ratio, we should have over 300 men/women pursuing the office of the President of the U.S.

C. But, we don't - Where is our leadership?

II. Definition of a leader/leadership

A. Responsibility.

1. Self motivated.
2. Self leader.
3. A professional leader.
4. Examples of leaders.
    - a. Jesus
    - b. Caesar
    - c. Lincoln
    - d. Churchill

B. Leadership Functions.

1. Planning.
2. Decision making.
3. Guiding.
4. Role modeling.

C. Leadership Activities.

1. Establishing goals.
2. Planning.

3. Cultivating linkages.
4. Consolidating resources.
5. Promoting.
6. Standards.
7. Inservicing.
8. Gatekeeping.
9. Recognizing outstanding achievement.

D. Leadership Character in Practice.

1. Think positive.
2. Give credit to others.
3. Respond enthusiastically to ideas.
4. Mind priorities.
5. Set goals.
6. Self evaluate.
7. Get into the field.
8. Be accessible.

E. Goals.

1. To be able to plan effectively, goals must be established.
2. Planning is the strategic element in decision making.
3. Elements of a good goal:
    - a. Single key result
    - b. Specific and quantifiable result
    - c. Within area of your responsibility
    - d. Understandable by all
    - e. Realistic and attainable

F. Planning.

1. Planning involves short and long range plans.
2. "What needs to be done?" - proper planning will eliminate failure.

3. "You will never know how you are going to get there, much less whether or not you have gotten there, if you do not know where you are going."

4. What it takes to plan:

   a. Discipline
   b. Forward thinking
   c. Courage
   d. Confidence

5. Managerial Personnel.

   a. Spend 95% of their time reacting to daily problems
   b. Spend 5% of their time in planning
   c. Thus becoming a problem solver and not a leader or manager
   d. 25% of time should be spent in planning
   e. Don't become the doer of the tasks
   f. Management doesn't equal labor (it is not physical labor), your money is made in management

G. Steps in Decision Making.

1. Decision making is a skill and it can be learned.

2. Steps and definitions:

   a. Identify the problem

      1. Look beyond the symptoms of the problems

   b. State the basic objective of your goal

      1. Objective focuses on your thoughts of the real problem to be solved.

   c. State constraints, assumptions and facts

      1. Constraints are factors which limit the outcomes and cannot be changed
      2. Assumptions are applied to factors which can be changed to simplify the problem and make it solvable
      3. Facts are statements of things that are known

   d. Generate possible solutions

      1. This is creative thinking
      2. Don't prejudge ideas as they are generated
      3. Get all the different ideas you can

e. Evaluate and make decision

   1. Determine which possible solution is most likely to solve the problem

f. Analysis

   1. Separate the chosen possible solution into meaningful elements
   2. Determine and gather the information you need to develop each element

g. Synthesis

   1. Combine the elements to create a detailed solution

h. Evaluate the solution

   1. Does it satisfy basic objective
   2. Is it feasible, practical, economical, safe, legal and moral
   3. Are there any negative consequences

i. Report results - make recommendations

   1. Prepare a report that describes what you have done and decided
   2. Think about the information needs of the person who will read the report
   3. Don't write what isn't necessary

j. Implement decision

   1. What should be done now
   2. Should additional information be gathered, a new objective selected or implementation of the recommendation begun

k. Check the results

   1. Did the solution work
   2. Is further decision making effort required

H. Guiding.

1. Delegate.

   a. Objectives and goals
   b. Check points along the way
   c. Both contribute and create the end results

I. Personnel Management.

1. A difficult area due to the complexity of Human Beings.

2. Personnel Management involves:

   a. Planning
   b. Organizing
   c. Directing
   d. Controlling

3. To be able to control:

   a. Know individuals
   b. Have a good perception of individual needs and your needs

Option Unit

Beef Production

Instructor's Guide:

1. Utilize the information as listed under resource as instructional material for Beef Production.

Resource:

1. Cow-Calf Management Guide - Cattleman's Library
   Dean Frischknecht - Extension Animal Science Specialist
   Withycomb 212
   Oregon State University
   Corvallis, Oregon 97331

Option Unit

Sheep Production

Instructor's Guide:

1. Utilize the information as listed under resource as instructional material for Sheep Production.

Resource:

1. The Sheepman's Production Handbook
   Sheep Industry Development Program
   200 Clayton Street
   Denver, Colorado 80206

Option Unit

Swine Production

Instructor's Guide:

1. Utilize the information as listed under resource as instructional material for Swine Production.

Resource:

1. Oregon Pork Producers Handbook
Dean Frischknecht - Extension Animal Science Specialist
Withycomb 212
Oregon State University
Corvallis, Oregon 97331